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ABSTRACT

This packet contains the instructional materials necessary for presentation of the seventh of ten modules that comprise a portion of the National Training and Development Service Urban Management Curriculum Development Project. This module focuses on capital facilities planning in local government finance. Capital facilities planning encompasses activities that attempt to provide public improvements for a community in a timely and orderly manner. The module materials address government responsibility, investment decisions, population estimates, finance methods, municipal bonds marketing, and debt administration. (Author/MK)

CAPITAL FACILITIES PLANNING AND DEBT ADMINISTRATION

Prepared by Dr. Alan Walter Steiss

Module Number Seven
of
POLICY/PROGRAM ANALYSIS AND EVALUATION TECHNIQUES Package VI

Developed by

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The author also would like to thank the staff of the Department of Planning and Budget, City of Rurbania--and especially to Woodley Blueridge, Joseph P. Furd, Stanley R. Farkel, and Arnold Trunion--for permitting their story to be told through the various case studies in this module.

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CHAPTER 1

CURRICULUM MODULE SCOPE AND PURPOSE

Capital facilities planning involves a unified set of procedures for evaluating and scheduling needed public improvements. The end product of these procedures -- the capital budget -- sets forth critical decisions regarding the distribution of available financial resources in the provision of major public works. The problem of effectively allocating resources for public improvements is complicated by the uncertainty of future conditions. It cannot be assumed that a community will remain static during the life span of any capital facility. Therefore, capital facilities planning must be undertaken as a function of changing public requirements and the fiscal capacity of the community to support these improvements. As Coleman Woodbury has suggested, capital facilities planning offers a new definition of comprehensive planning. The good intentions embodied in a comprehensive plan -- the goals and objectives, the policies and projections -- can be converted into reality through the orderly procedures of capital facilities planning.

A well-developed theory of capital facilities planning does not exist within the governmental sphere comparable to that developed for the evaluation of long-range business investment decisions. Consequently, no abstract body of principles is available to judge the adequacy of capital budgeting procedures in the public sector. Governments for some time have recognized the value of budgeting for operating expenses. Only recently, however, has the budgeting of capital expenditures been accorded the same status.

To view capital facilities as merely an addendum to other functions of local government is to foster a misconception of the process and role of providing public services. Improper scheduling of the construction of public improvements will not only inhibit the delivery of adequate levels and mixes of public services, but will impede the orderly development of the community. A major objective of capital facilities planning, therefore, should be to provide data and information on future needs and resources of the community. This information should be sufficiently reliable to justify policy decisions involving long-term and relatively large commitments of public resources.

MODULE FORMAT AND OBJECTIVES

It has been said that "a picture is worth a thousand words". In the field of public service education, first-hand experiential applications of new concepts and techniques often are worth a thousand pages

of theoretical textbook presentations of these same concepts and techniques. This is not to suggest that cookbook, "how-to-do-it" materials can or should replace a good theoretical grounding in urban management concepts and techniques, but rather that many contemporary tools of management can only be fully appreciated through real-world (or near real-world) applications.

One of the central problems, however, in the development of effective educational programs for urban management personnel is the almost total lack of good instructional materials to provide student participants with a "hands-on" experience in dealing with new concepts and techniques. While textbook case studies report on the experiences of particular localities in the application of various new management techniques, these presentations provide only limited opportunity for the student to work through problem situations and to experience firsthand the "discovery of application." Numerous "war stories" also can be drawn from the firing-line experiences of urban management practitioners. These anecdotal materials, however, seldom provide the necessary content to be used for instructional purposes.

As a consequence, new concepts and techniques in the field of urban management are either presented in the abstract, leaving students and practitioners to their own devises to discover potential applications to more specific problem situations, or are discussed as fait accomplis, providing little opportunity to discern the internal problem-solving mechanisms employed in the application of these techniques. Thus, the recalcitrance among public service personnel regarding the use of new methods often stems from the lack of tangible examples of application. A fundamental objective of this curriculum development project, therefore, is to provide a vehicle to assist in circumventing these impediments to fuller application of public management concepts and techniques.

Module Focus and Approach

This curriculum module, the seventh in a series prepared by the staff of the Center for Urban and Regional Studies at Virginia Tech, focuses on capital facilities planning as a component in the process of Policy Analysis and Evaluation. The module consists of instructional materials and a series of five case studies and related scenario problems that trace the procedural steps in the formulation of a capital facilities plan and capital improvements program, the identification of appropriate strategies for financing capital expenditures, the issuance of municipal bonds, and the administration of the resulting public debt.

The instructional materials in this module are based on a major textbook by Dr. Alan Walter Steiss, entitled LOCAL GOVERNMENT FINANCE: CAPITAL FACILITIES PLANNING AND DEBT ADMINISTRATION, published by Lexington Books-D.C. Heath and Company (1975) of Lexington, Massachusetts. This text, along with several other books cited in the accom-

panying bibliography, serve to further elaborate the points discussed in these instructional materials.

The case study/scenarios illustrate critical steps in the procedures and techniques of capital facilities planning and cover the following topic:

(1) Long-Term Investment Decisions (chapter 3)

(2) Population Estimates and Projections (chapter 4)

(3) Revenue and Expenditure Analysis (chapter 5)

(4) Capital Improvements Programming Procedures (chapter 6)

(5) Debt Administration (chapter 8)

The case studies are drawn from real-world situations suggested by the experiences of urban management practitioners. Each case study provides closure on a problem situation, illustrating a given set of concepts, methods, and/or techniques that participants will require to solve the associated scenario problems. Basic concepts also are discussed in the instructional materials to clarify the application of particular techniques. Of necessity, certain abstractions have been made in the case studies so that they will be manageable within a workshop/seminar format.

The scenarios build upon the case studies (utilizing data, assumptions, situational and contextual factors, etc.). These scenarios require additional participant inputs beyond the case study, however; i.e., they involve more than the mere mechanical application of techniques outlined in the case studies. One obvious component of the scenario problems would involve an analysis and critique of the assumptions and methodologies applied in the case studies.

Each case study/scenario includes an "instructional guide" that outlines the basic objectives covered, identified relevant supporting information with which the participants should be familiar, and as appropriate, provides a solution or range of possible solutions to the scenario problem. These instructional guide may be distributed separately after the conclusion of the discussion on the scenario problem or may be used as part of that discussion.

Instructional Assumptions

The case study/scenarios are designed to be used primarily as part of a short course/workshop in conjunction with in-service training programs for public managers and local government officials. The module represents 16 to 24 didactic hours, the time duration depending on the pre-workshop reading of instructional materials that may be done by the participants. The modules may be used in concert with an intensive

lecture/seminar format that combines a high level of participant input within a fairly structured learning environment. These instructional materials would also have application in public administration and urban affairs curricula at the upper division undergraduate and at graduate levels.

The case study/scenarios can be combined in various ways in accordance with participant needs. They are also adaptable to a variety of presentation formats (e.g., a series of relatively short in-service workshops spread over several months, more intensive training institutes, perhaps used in combination with materials from other modules in this series, quarter or semester long credit courses, etc.). The case studies and scenarios can also be used in conjunction with the instructional materials as a "self-study" package by individuals. Practitioners might find application of the case study/scenarios, independent of any formal instruction, to demonstrate the utilization of particular management techniques, as for example, to provide a "walk through" experience for members of city council.

In short, while the materials are designed primarily for use in conjunction with an instructor/facilitator, they are sufficiently self-contained to be applied in several other contexts, including use as "self-study" materials. Instructors using these materials in more formal workshop or classroom settings should have some knowledge of capital facilities planning and debt administration procedures, as well as broader applications of public budgeting techniques (the subject of curriculum module 6 in this series). Expertise in these areas is not assumed, however, and an instructor should be able to gain sufficient familiarity with these basic concepts by consulting the various textbooks listed in the accompanying bibliography.

No special equipment or reference materials are required beyond that which is provided in the curriculum package, aside from the desirability to have small electronic calculators available for participants to work out portions of the scenario problems (such calculators that have a memory and reciprocal function are advised). If used in conjunction with an academic course, many of the computational routines are adaptable to computer operations. Repetitive computations can be derived from the instructional guides, however, to facilitate the use of these materials in more intensive workshop sessions (i.e., participants may be required to set up the problem for solution without having to work through all of the calculations).

Module Audience

The primary audience for these case study/scenarios and supporting instructional materials will be urban managers--city managers, urban county administrators, department heads, planning staff members, and other similar public service personnel with responsibilities for capital budgeting and capital construction (and degree candidates preparing for such public service careers). The materials could also be used in conjunction with in-service career development programs. And

as suggested above, they may also prove useful as "briefing mechanisms" for elected and appointed officials.

SUMMARY OF MOODULE COVERAGE

Following this overview, chapter two traces the emergence and development of budgeting procedures as a function of government and delineates the basic components of capital facilities planning. Responsibilities of local government for the planning of capital facilities are outlined in this chapter, including an allocation of these responsibilities among the chief executive, legislative body, various operating departments, and the finance and planning agenices.

Chapter three looks at procedures widely applied in business and industry for the analysis of long-term investment decisions and the potential transfer of these techniques in the public sector. The case study on the use of discounted cash flow methods by the XYZ Corporation provides a foundation for the potential application of these techniques to investment decisions before the Rurbania Sewer and Water Utility Commission. (Rurbania is the not-so-hypothetical community that provides the data base for analysis throughout this curriculum module.)

Analysis of demographic conditions is an essential element in the formulation of a capital facilities plan. The demand for public improvements is a function of growth; population data must be sufficiently disaggregated to anticipate the range and types of public improvements that the community will require in the future. Chapter four examines techniques for identifying and forecasting population by age cohorts as a basis for analyzing capital facilities needs. The case study traces the procedures used by Woodley Blueridge to develop current population estimates for the City of Rurbania, while the scenario problem extends this analysis to the formulation of six-year population projections for Rurbania to correspond with the capital improvements programming period.

Capital facilities planning must build upon sound fiscal policies and long-range financial planning. A public improvement financed by a 20-year municipal bond must assume that the municipality has assessed its revenue expectations and expenditure commitments before this long-term resource obligation is approved. Chapter five discusses various techniques for forecasting the levels of revenue and expenditures required to meet capital and operating commitments. The case study provides a revenue and expenditure analysis for Rurbania for the current budget period. Based on these data and techniques, the third scenario problem requires an extension of this analysis for the remaining five years of the capital improvements plan.

Chapter six discusses various methods for financing public improvements, including "pay-as-you-go," special benefit assessments and excess condemnation, the development of capital reserve funds, and various forms of long-term borrowing through the issuance of municipal bonds. The case study summarizes the capital improvements programming proce-

dures and recommendations made by Stanley Farkel in conjunction with Rurbania's public school system. These capital improvements procedures are further extended in light of the population projections resulting from scenario 2 to up-date the capital commitments of the City of Rurbania to educational facilities.

Procedures for the marketing of municipal bonds are discussed in chapter seven. Included in this chapter are an examination of the informational requirements of the Notice of Sale and bond prospectus; discussions of the timing of bond issues, the costs involved in marketing municipal bonds, and municipal bond ratings; and an outline of the procedures governing the sale of bonds.

Chapter eight deals with procedures for debt administration, including reporting and recordkeeping requirements, the accountability of funds, procedures for making debt service payments, and the management of sinking funds in conjunction with term bonds. Defaults and debt readjustments are also discussed in this chapter. The final case study examines various aspects of debt administration as related to the long-term commitments of the Rurbania Sewer and Water Utility Commission, while the scenario explores the adjustments required in the Commission's statement of income and expenses in anticipation of the development of additional supply capacity to meet rising demands.

Local governments are faced with many public expectations that often are dichotomous. While the public demands greater responsiveness and effectiveness in the provision of government services (in terms of scope and coverage), it also expects greater responsibility -- efficiency and economy -- in the financing of government operations. Demands for new and improved public services and facilities often outstrip the capacity of government to finance these community needs from traditional sources. As a consequence, many local governments are faced with a fiscal dilemma that, without proper planning and management, can evolve into a "fiscal crisis". Increases in local taxes are likely to generate adverse taxpayer reactions, while cutbacks in services are likely to produce similar "hues and cries" from the public. An objective of these curriculum materials is to provide urban managers with further insights into mechanisms and processes available to deal with this fiscal dilemma as it relates to the planning, programming, and budgeting of vital public improvements.

GLOSSARY

Accrued Interest: interest earned on a bond since the last coupon payment.

Ad Valorem Tax: a tax based on the assessed value of real (land and improvements) and personal property.

Amortization (of bonds): a straight-line reduction of debt by means of periodic payments sufficient to meet current interest and to liquidate the debt (pay down the principal) at a maturity.

Assessed Valuation: the valuation placed on property for the purpose of taxation; generally property is assessed at well below 100 percent of the market value.

Assessment Ratio: the ratio of the assessed value of property to the full or true property value; full value may be defined as fair market value at the bid side of the market less a reasonable allowance for sales and other expenses.

Authority: a quasi-public corporation created by one or more governmental bodies to carry out certain functions, either within a community or among several communities. These are often a "proprietary," revenue-producing nature, such as providing a water supply, sewage treatment facilities, or building and maintaining roads, bridges, or ports and air terminals for which tolls, rents, or other user charges may be imposed.

Basis Book: a book of mathematical tables used to convert yield percentages to equivalent dollar prices.

Basic Price: the price expressed in yield or net return on the investment.

Bear Market: a period of generally pessimistic attitudes and declining market prices (compare: Bull Market).

Bearer Bond: a bond that has no identification as to owner; it is presumed to be owned, therefore, by the bearer or the person who holds it.

Blighted Area: an area in which a substantial proportion of the dwellings are unsafe, unsanitary, dilapidated, obsolescent, or so lacking in light, air, or space as to be conductive to unwholesome living; may include industrial buildings that are no longer used and have been allowed to fall into a state of disrepair, or residential districts where the structures for various reasons are detrimental to health, safety, morals, or welfare.

Blue List: a daily list of dealers' municipal bond offerings published by the Blue List Publishing Company.

Bond: an interest-bearing certificate of debt representing the obligation of a public body to repay a certain sum--usually issued in $1,000 units--on a specific date, with interest at a fixed rate to maturity.

Bond Anticipation Notes (BAN): short-term notes sold in anticipation of a bond issue and retired by proceeds from the sale of the bonds.

Bond Buyer: a daily trade paper of the municipal bond business; it also publishes The Weekly Bond Buyer, devoted to capital market news

as well as providing a wrap-up of municipal news, and a monthly "pink sheet," listing all bond sales for a given month.

Bond Discount: the amount by which the face value of a bond exceeds the purchase price.

Bond Issue: generally a certain number of bonds marketed at one time by a municipality, school district, or other public organization.

Bond Premium: the amount by which the purchase of redemption price of a bond exceeds the face value.

Bonds-General Obligation: "tax supported" bonds for which the full faith and credit of the government issuing the bonds is pledged.

Bonds-Maturity: the date on which the principal amount of a bond becomes due, or the period intervening between the date of issue and the due date; a bond issued in 1961 and due in 1980 would have a 20-year maturity.

Bonds-Retirement: the payment of the principal of the bond or bonds at the maturity date, or by purchase or redemption.

Bonds-Revenue: bonds payable from revenues derived from the use of a facility, such as bridge tools, water rents, and the like; the credit and taxing capability of local government is not necessarily pledged in support of such bonds.

Bonds-Serial: bonds maturing in periodic, generally annual, installments as opposed to "term bonds."

Broker: middleman who brings buyers and sellers together and handles their orders, generally charging a commission for his services; in contrast to a principal or a dealer, the broker does not own or take a position in the security.

Bull Market: a period of generally optimistic attitudes and increasing market prices (Compare: Bear Market).

Callable: feature of a bond whereby it may be redeemed by the issuer prior to maturity under terms designated prior to issuance.

Capital Budget: a plan for the expenditure of public funds for capital purposes, showing as income the revenues, special assessments, free surplus, and down payment appropriations to be applied to the cost of a capital project or projects, expenses of issuance of obligation, engineering supervision, contracts, and any other related expenses.

Capital Expenditures: nonrecurring payments for capital improvements including construction, acquisition, site development and overhead costs. The fees for architects, engineers, lawyers, and other professional services plus the costs of financing, advance planning may be included.

Capital Improvements: acquisition, construction, replacement of, or major repairs to capital plant facilities, with a relatively long useful life.

Capital Improvements Program: a comprehensive schedule for staging the construction or acquisition of capital improvements and the allocation of costs by sources or revenue, in accordance with a system of priorities, usually covering a period of five or six years.

Capital Plant: buildings and other facilities needed for the operation of public services provided by local government, including

schools, roads, water and sewer systems, street lights, parks and playgrounds, harbor improvements, police and fire department headquarters, administration buildings, and libraries and health centers, among other facilities.

Capital Reserve Deposits or Capital Improvements Fund Deposits: deposits by a municipality, county, or school district of current revenues in a special fund called a "building fund," capital reserve fund," or "capital improvement fund," which may be used for payments for capital improvements or debt service.

Capitalization: the translation of an annual revenue or expenditure into terms of capital value or capital cost, on the basis of a fixed ratio.

Comprehensive Plan, Master Plan, or General Plan: a long-range plan in graphic and written form for the coordinated, rational, future development of a community based upon past and present trends, existing conditions, as well as estimates and projections of future trends and conditions. It concludes proposals for such improvements as schools, parks, roads, and sanitation facilities.

Concession: the allowance (or profit) that an underwriter permits a nonmember of the account; sometimes referred to as a dealer's reallowance.

Coupon: that part of a bond which evidences interest due. Coupons are detached from bonds by holders (usually semiannually) and presented to the issuer's designated paying agent, or deposited in his own bank for collection.

Coupon or Interest Rate: the annual rate of interest payable on a bond, note, or any other fixed income obligation, usually expressed as a percentage of the principal amount, which the borrower promises to pay to the bondholder.

Coverage: this term is usually associated with revenue bonds and indicates the margin of safety for payment of debt service, reflecting the number of times by which earnings for a given period exceed debt service payable in such period.

Current Yield: a relation stated as a percent of the annual interest to the actual market price of the bond.

Debt Financing: the financing of the cost of capital improvements by the creation of debt (usually done by the issuing of bonds).

Debt Limit (or Debt Ceiling): the maximum debt that may be incurred by a local government, school district, or state, usually expressed as a percentage of the net debt to the "equalized valuation basis."

Debt Schedule: a schedule showing annual payments for interest, principal, sinking funds, and other deposits to be used toward the payment of principal maturities.

Debt Service-Aggregate: total debt service over the life of a bond.

Debt Service-Annual: total debt service falling due in any one year.

Debt Service-Level: a bond issue where approximately the same amount is paid for total debt service during each year of the life of the bonds. Under this approach more bonds mature during the later years of the issue.

Default: failure to pay principal or interest promptly when due; if caused by a minor omission that is remedied promptly, known as a technical default.

Discount: the difference between the cost price of a security and its value at maturity when quoted at lower than face value. A security selling below original offering price shortly after sale also is considered to be at a discount.

Dollar Bond: a bond that is quoted and traded in dollars rather than in yield.

Down Payment: payment for a capital improvement from current revenues or reserves, as opposed to borrowed funds.

Face Value: the par value of a bond that appears on the face; this is the amount that the issuer promises to pay at maturity, and also the amount on which interest is computed.

Flat Scale: little or no difference between short-and long-term yields over the maturity range of an issue.

Floating Debt: temporary or shifting short-term debt that has not been funded on a permanent basis into longer maturities.

General Obligation: a bond secured by pledge of the issuer's full faith, credit, and taxing power.

Gross Debt: the sum total of a debtor's obligations.

Gross Yield: the percentage return on a security that is determined by dividing the dollar price into the annual interest payment and calculating the return to maturity.

Industrial Revenue Bond Financing: the means by which a municipality or development corporation issues and sells its revenue bonds to build an industrial plant to be leased to a private corporation.

Interest: compensation paid or to be paid for the use of money.

Interest Rate: the interest payable each year, expressed as a percentage of the principal.

Inverted Scale: when the yield is higher on the shorter maturities than on the longer ones.

Issuer: a municipal unit that borrows money through the sale of bonds.

Legal Opinion: an opinion concerning the legality of a bond issue usually written by a recognized law firm specializing in the approval of public borrowings.

Limited Tax Bond: a bond secured by the pledge of a special tax, a group of taxes, or specified portion of the real estate tax that is limited as to rate or amount.

Liquidity: the ability to convert a security into cash promptly with minimum risk of principal.

Marketability: a measure of the ease with which a security can be sold in the secondary market.

Maturities Level: a bond issue in which the same amount of principal becomes due each year during the life of the bonds. This means declining debt service as the bonds are paid off and interest is reduced.

Maturity: the date upon which the principal or stated value of a bond becomes due and payable.

Municipals: a term used to apply to the bonds issued by a whole range of domestic public agencies and authorities below the level of the United States government (states, counties, cities, town, schools and various special purpose districts or agencies).

Net Debt: gross debt less sinking fund accumulations and all self-supporting debt.

New Housing Authority Bonds: bonds issued by a local public housing authority to finance public housing and backed by federal funds and the solemn pledge of the United States government to see that this payment is made in full.

New Issue Market: market for new issues of municipal bonds.

Noncash Credit: an amount representing a payment by a local government or school district for a public improvement contributing to the rebuilding of an urban renewal area. For this the local government may take credit, as part of the "net project cost," in its application for a federal capital grant in an urban renewal program.

Operating Budget: the annual budget adopted by a municipality or school district each year, showing an itemized list of proposed operating expenditures, revenues, or other available funds by source.

Over-the-Counter Market: a securities market that is conducted by dealers throughout the country through negotiations rather than through the use of an auction system as represented by a stock exchange.

Overlapping Debt: that portion of the debt of other governmental units for which residents of a particular municipality are responsible.

Par Value: the stated or face value of a bond; the amount of money due at maturity.

Pay-As-You-Go: payment on capital improvements from current revenues.

Premium: the amount by which price exceeds par amount or maturity value of a bond; also the amount payable to the holder of a callable bond by the issuer, if and when the bond is called.

Prime Rate: interest rate charged by banks for loans to their prime or most creditworthy customers.

Principal: the face or par value of an instrument, exclusive of accrued interest.

Priorities: the order of precedence, in time and importance, among a number of different capital improvements.

Ratings: designations used by investors' services to give relative indications of quality.

Redevelopment: the process of acquiring land, demolishing existing structures, and making the cleared space available for new development. The purpose of this is to eliminate conditions of blight that cannot be controlled or remedied by regulations (housing codes, sanitation regulations, etc.), and that cannot be dealth with effectively by private enterprise. The acquisition of land, relocation of occupants of the site, and the clearing and replanning of the area is carried out by a public agency. The rebuilding of the site may be undertaken by a private developer or a public agency.

Refunding: a system by which a bond issue is redeemed by a new bond issue under conditions generally more favorable to the issuer.

Registered Bond: a bond whose owner is registered with the issuer or its agents, either as to both principal and interest or as to principal only.

Revenue Bond: a bond payable from revenues secured from a project that pays its ways by charging rentals to the users, such as toll bridges or toll highways, or from revenues from another source that are used for a public purpose.

Scale: reoffering terms to the public of a serial issue showing price or yields offered to each maturity.

Self-Liquidating Utility: a municipal public utility (such as a water or sewer system, toll bridge or public parking lot) in which the cash receipts from fees, rents, or other charges, made during the fiscal year are enough to meet debt service and operating and maintenance costs (excluding depreciation and obsolescence).

Self-Supporting Debt: debt incurred for a project or enterprise requiring no tax support other than the specific tax or revenue earmarked for that purpose.

Serial Bond: a bond of an issue that has maturities over a period of time for retirement of a debt.

Sinking Fund: a reserve fund accumulated over time to liquidate or retire a known obligation on the date of its maturity or call date.

Special Assessment Bonds: bonds payable from levies on the property presumably benefited by the improvement being financed; the issuing government agrees to make the assessments and earmark the proceeds for debt service on these bonds.

Special Tax Bond: a bond secured by a special tax, such as a gasoline tax.

Spread: the gross profit in an underwriting, assuming that all bonds are sold at the initial offering price.

Staging: the planning or programming of the construction of capital improvements over time when needed and when the community has the ability to pay.

Syndicate: a group of investment bankers who buy (underwrite) "wholesale" a new bond issue from the issuing authority and offer it for resale to the general public.

Take-Down: the discount from the list price allowed to a member of an underwriting account on any bonds he sells (sometimes referred to as a take-down concession).

Tax-Exempt Bonds: a term applied to municipal bonds of state and local governments or agencies; the interest on municipal securities is exempt from federal income taxes.

Term Bond: a bond of an issue that has a single maturity.

Trading Market: the secondary market for issued bonds.

True or Market Value: the value determined by the state as the true value of taxable real property in a community for the purpose of allocating state aid to education; usually taken as the price at which a willing buyer would purchase the property from a willing seller.

Trustee: a bank designated as the custodian of funds and official representative of bondholders.

Underwriter: a bank, or other financial institution that purchases new issues of securities for resale.

Unlimited Tax Bond: a bond secured by pledge of taxes that may be levied in unlimited rate or amount.

Urban Renewal: undertakings by a local government for the elimination of blight in a designated "urban renewal area." This would be a slum area or a blighted, deteriorated or deteriorating area approved by the Department of Housing and Urban Development as appropriate for an urban renewal project. Urban renewal may involve redevelopment, rehabilitation, or conservation.

Yield: the rate of annual income return on an investment, expressed as a percentage. (1) Income yield is obtained by dividing the current dollar income by the current market price for the security. (2) Net yield or yield to maturity is the current income yield minus any premium above par or plus any discount from par in purchase price, with the adjustment spread over the period from the date of purchase to the date of maturity of the bond.

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CHAPTER 2

GOVERNMENT RESPONSIBILITY FOR CAPITAL FACILITIES PLANNING

A primary purpose of government is to provide on a collective basis that which cannot be achieved through individual action. Fulfillment of this purpose generates two fundamental responsibilities of government: (1) the regulation of individual actions to ensure that they will not be detrimental to the general public; and (2) the provision of public services and facilities for the mutual benefit of all or a majority of citizens. Both of these responsibilities stem from the broad objectives of government to "promote the general health, safety, morals, and public welfare."

The imposition of regulations and controls in the public interest is as old as history itself. Although of much more recent origins, the provision of public facilities and services has become widely accepted as a basic responsibility of government in contemporary society. While segments of the public may complain when taxes are increased to provide new schools or to expand public health and welfare programs, it is generally acknowledged that significant economies can be achieved by such governmental activities -- economies that could not be derived if each citizen had to provide for these facilities and services on an individual basis.

Recent Emergence of Public Budgeting

As government began to assume greater responsibilities for the provision of public services and facilities, however, only the most evident needs were addressed, and these were dealt with in somewhat haphazard fashion. Municipal development during this period was characterized by the uncoordinated construction of public works. If any financial resources remained after the most obvious obligations were met, other projects might be initiated. As recently as 1910, state and local governments made no provision for the overall supervision and regulation of public expenditures through a comprehensive budgetary process.

Three successive stages in the development of modern procedures for public budgeting can be identified over the past sixty-five years.[1] The dominant emphasis in the first stage, dating roughly from 1920 to 1935, was on the development of adequate mechanisms for the control of public expenditures. The budget was viewed as a safeguard against administrative abuse of public funds. This period was strongly influenced by the government reform movement, particularly at the local level.

The second stage in this evolution was management-oriented, with emphasis placed on the efficient performance of work and prescribed activities. The performance budget -- officially introduced by the Hoover Commission in the forties -- was a major contribution to this management-orientation. Performance budgeting is designed to prepare and interpret financial plans in terms of

services to be performed. Attention is directed to ends rather than means as the significant element in financial planning and expenditure authorization.

The third stage is reflected in more recent developments which have their roots in Keynesian economics and the new technology of systems analysis. Keynesian economics was important in the transition from the utilization of fiscal policy to achieve economic objectives to the utilization of the budget process to achieve fiscal objectives. Current efforts to link the processes of planning and budgeting into a multipurpose system (program budgeting) exemplify this third stage in the development of modern public budgeting.

While modern concepts of performance and program budgeting are making gradual inroads into more traditional procedures for managing local finances, long-range capital facilities planning has lagged significantly behind other developments in the field. As the Advisory Commission on Intergovernmental Relations has reported:

> The usefulness, indeed the necessity, of long-term capital planning cannot be over-emphasized. While most states have statutory requirements as to annual budgeting by local governments and some require the filing of local operating budgets with state agencies, the need for a capital budget is only beginning to be recognized. The states should foster the development of local capital budgets and, in conjunction with their programs of technical assistance to local debt management, should require that such budgets be filed with the state agency administering such assistance.[2]

Thus, the Commission's report concluded that no aspect of budgeting is of more importance than the planning of long-term capital expenditures. "Indispensable as are data of the past and current condition of local governments, debts are paid in the future; and a knowledge of future financing, even on an estimated basis, is a tool of the first importance in both the local and state evaluation of proposed bond issues."[3]

It is difficult to achieve maximum returns from public investments if they are made on a year-to-year basis. Operating programs can be altered fairly rapidly to meet changing conditions, but a major facility that is inappropriately located or misdesigned constitutes a continual drain on governmental resources. To ensure the proper balance of revenues and expenditures, it is necessary to develop sound long-range capital facilities plans. Such plans must include estimates of expenditures both for capital improvements and for the operation and maintenance of related public services, together with estimates of revenues from taxes, borrowing, and other sources necessary to finance these expenditures. To be effective, a capital facilities plan must be developed for a relatively long time period, must allow flexibility for adjustment as new conditions arise, and must be based upon an overall strategic plan that includes a long-range program for the provision of public services.

The Advantages of Capital Facilities Planning

Long-range capital facilities planning has many obvious advantages. It provides a means of assuring that projects will be carried out in accordance with a well thought-out and defendable system of priorities reflecting both public needs and the government's ability to pay. It promotes coordination among the various departments and agencies of government and thereby circumvents overlapping or conflicting programs. It protects against undue influence of pressure groups representing special interests that, from time to time, may attempt to force the adoption of projects at the expense of more urgent or more meritorious improvements.

Through capital facilities planning, required bond issues or the need for other revenue producing measures can be foreseen and action taken before the need becomes so critical as to require emergency financing measures. Advance planning lengthens the period of time available for the proper technical design of projects and facilities. It also permits a continual, systemic appraisal of personnel and equipment needs, resulting in a number of economies. And finally, the planning of capital facilities may provide justification for the advance acquisition of properties needed for improvements, thereby taking advantage of lower market values.

A capital facilities plan will not solve all of the fisal problems of local government. It may or may not result in a reduction of taxes or public debt. However, it should result in a more expeditious and wise expenditure of public funds, whereby each dollar spent yields a more effective return in terms of desired public improvements. Capital facilities planning assists in the provision of suitable responses to public needs, of appropriate quality, when and where they are required.

Basic Components of Capital Facilities Planning

The terms capital facility, capital improvement, or public works usually refer to projects of large-size, fixed nature, and/or relatively long life (a minimum of 10 to 15 years), involving expenditures of a non-recurring nature, designed to provide new or expanded governmental capacity for the delivery of public services. Thus, funds allocated for the design and construction of a new health clinic would be considered a capital expenditure, whereas monies appropriated to sustain the operations of such a facility, in terms of salaries, supplies, contractual services, and so forth, should be included in the annual operating budget. Equipment required at the time of acquisition or construction of a facility often is included as part of the capital improvements program. However, expenditures for minor equipment acquisitions and most repair work should not be included as part of the capital expenditures.

The many factors that influence the growth and development of a community must be considered in capital facilities planning. Goals and objectives must be formulated and translated into policy decision. Alternative courses of action must be analyzed and strategies recommended to achieve these goals and objectives.

Each government must determine what standards or levels of service are desirable for its citizens and what these standards mean in terms of public improvements. Service standards provide important mechanisms for assessing existing facilities and programs in light of desirable objectives.

To translate standards of service into future capital needs, it is necessary to have a well-founded estimate of future population and its demographic and spatial distribution in fairly detailed breakdowns. Such an estimate permits each agency to match standards of service against its potential "clientele".[4] Applying this estimate, it is possible to determine the extent of new or additional facilities needed and the sequence and timing required to ensure that these facilities are available when the need arises.

Capital improvements programming focuses on the arrangement of proposed capital facilities projects in a sequential order based on a schedule of priorities. It involves the assignment of a "price tag" to projects over a more immediate time period. Capital improvements programs are developed for a specific period, usually six years. While the overall capital facilities plan should extend over a much longer time period, it is obvious that such a plan is subject to many uncertainties. It is neither possible nor necessary to be as specific and exacting in planning over this longer period as it is in determining the schedule for capital expenditures for the more immediate future. Therefore, within the broader framework of the long-range capital facilities plan, the more immediate portions are generally developed in greater detail and are incorporated into a six-year capital improvements program. There is no magic to the number "six", but governments have generally found that this is a convenient period for detailed programming of capital expenditures, permitting sufficient "lead time" for the design and other preliminary work required by such projects.

Each successive first year of a six-year capital improvements program becomes the capital budget. The capital budget represents a specific authorization by the legislative body against which annual appropriations are made. Too often, however, a capital budget is developed with insufficient attention to the impacts it will have on the annual operating budget. Many expenditure items which are relatively fixed in the short run become highly variable when analyzed from a longer range perspective. Therefore, it is important that capital facilities plans be formulated in conjunction with appropriate operating agencies and that capital improvements programs include estimates of operating costs for at least the initial fiscal periods following the completion of the project.

While short-range program decisions may be made in the absence of planning because the needs are so evident, the long-range implications of capital expenditures cannot be anticipated without the firm foundation of a comprehensive plan. The planning process provides a basis for determining

the likely magnitude and distribution of population, the location of industry and other economic activities, the relationship between development and resources (both human and natural), and offers important inputs concerning the evaluation, analysis, and establishment of project priorities. Until such a planning process is established as a regular function of government, any estimates of a jurisdiction's long-range needs and responsibilities for public improvements are likely to be in the realm of guesswork. To achieve the best results, programs are required to effectuate plans, and plans are needed to ensure that the full value of programming is realized.

There are several methods of financing capital expenditures. Generally, these methods are used in various combinations depending upon the nature of the individual project, the availability of revenue sources, and the stability of funds. The pay-as-you-go method, for example, is particularly adaptable to projects which can be developed on an incremental basis and/or those for which funds are relatively stable and not subject to periodic fluctuations. Borrowing, through the issuance of general obligation bonds or revenue bonds, is generally appropriate in cases where the initial outlay of funds for a particular project or series of projects would create a substantial drain on the financial resources of the locality. Financing from reserve funds is perhaps the most economical and reliable method made possible through long-range capital facilities planning. This approach involves the setting aside from annual revenues a given sum in advance of the projected needs in order to have sufficient capital on hand to initiate the project when the need arises. This method has the advantage of avoiding the interest charges incurred with the issuance of bonds (and, in fact, since reserve funds are usually invested, they can produce additional revenues) and is not as subject to fluctuations as in the case of the pay-as-you-go approach. The problem is to ensure sufficient safeguards so that these funds are adequate to meet demands and are not "tapped" for some other purpose as they are being accumulated.

The annual cost of any improvement program is determined by the planning, staging, and methods of financing, together with the projected operating costs. To be most effective, the programming of capital improvements should undertake to level off annual costs and to avoid erratic fluctuations. Annual costs, when measured against tax resources and available subsidies, determine the tax burden generated by the capital program. Total capital costs, together with the staging and financing methods, determine the overall debt burden. When the tax or debt burden becomes too great for public resources, it may be necessary to reduce the level of improvements scheduled until their costs fit to these resources.

The heart of a good capital improvements program is the development and application of a sound system of priorities to provide the method by which each project is measured against the total capital expenditure needs of government and through which a schedule is developed. While priority systems should have some degree of flexibility, they must be stable enough to offer substantial justification for the scheduling of projects and the allocation of funds within the capital improvements program.

Standards of service also must have a degree of "built-in" flexibility; to be meaningful, they must be representative of actual performance or benefits. As new operational techniques are introduced or as new demands arise, it is important that such standards be flexible enough to permit adjustments to meet these changing conditions.

Allocation of Responsibilities

The responsibilities for capital facilities planning are shared by a number of groups and individuals within government: the chief executive, the legislative body, various operating departments, the finance agency, and the planning agency. Each plays an important role in the decision-making process. As Coughlin has observed: "Each group attempts to look at the program as a whole and make decisions about its parts. But, because of its particular function and position, each group sees the problems with a slightly different emphasis."[5]

Operating departments, primarily concerned with their own efficiency, are likely to view the entire capital improvements program in terms of its impact on their own project requests. As a consequence, these departments will tend to over-emphasize the importance of their own project requests in the assignment of priorities. As the "watch-dog" of expenditures, the position of the finance agency is somewhat counter to that of the operating departments in that it must be primarily concerned with maximizing the returns from individual projects, while achieving economies in the total program. Since the finance agency must view each proposal critically to evaluate the potential "need" that it is designed to serve, this perspective often results in a heavy emphasis on the short-run implications of the capital facilities plan. The planning agency, in turn, must have a greater concern for the long-range implications and the functional relationship among projects as they fit together to further the objectives of the capital facilities plan. Frequently this requires that the planning agency develop projections beyond the immediate needs embodied in the "justifications" submitted by the operating departments to explore some of the more subtle ramifications of the individual project requests.

Ultimately, the decisions regarding capital expenditures must rest with the chief executive and the legislative body. As the elected representatives of the people, these officials must share a primary concern for the broader interests and the welfare of their constituents. However, their particular function and position dictates that they emphasize different aspects of the capital improvements program. The chief executive must assume a position that places primary emphasis upon middle-range objectives, falling somewhere on the continuum between the short-range emphasis of the finance agency and the longer-range viewpoint of the planning agency. He must also pay particular attention to the political consequences of the decisions that are made concerning capital expenditures. The legislative body must also take cognizance of the political implications of decisions, but generally tends to gravitate toward the more immediate objectives of the program, placing particular emphasis on the cost factors involved.

The drawbacks to this approach, in terms of the time required to carry out the process and the compromises that often are necessary, should be obvious. As one student of government has put it: "Rome wasn't built in a day -- but it would have taken a heck of a lot longer if the construction proposals had to go through our modern form of democratic government." To circumvent the delays which arise from this approach, the capital facilities plan and capital improvements program must be developed with a spirit of close coordination and cooperation among the various groups involved.

Summary and Conclusions

While the early literature of public finance and administration reflected a concern for honest administration of governmental resources, more recent studies have emphasized the services provided through the allocation of limited public resources. This new focus reflective of a shift in public budgeting procedures, from a concern for input and process to one of output and performance effectiveness. Performance budgeting, introduced in the forties, directed attention to the measurement of cost and accomplishment of detailed activities. Program budgeting, gaining acceptance in the sixties and seventies, focuses on top level review and decision-making and stresses comprehensive planning and programming as integral phases in the budgetary process. This new emphasis on comprehensiveness has particular significance for the activities of capital facilities planning and public debt administration.

Capital facilities planning involves a unified series of steps to carry out the policy aims of government. It must recognize the interrelated character of all expenditures, whether for new or existing program or capital outlays, and must provide for their joint evaluation in arriving at expenditure decisions. As a management tool, capital facilities planning provides a coordinative mechanism for all phases of capital construction -- estimation, submission, approval, execution, and post audit.

Budgeting, and in particular, capital budgeting, is a political process. With reference to community decision-making, Martin and others hypothesize that the capital budget is likely to be the single focus.[6] While any budget contains some "automatic" decision, the important fact is that most decisions relating to capital investment are policy decisions. Economic and other criteria are employed in the capital facilities planning process, but they are defined within the conditioned by the broader political context. Ultimately, the efficiency and effectiveness of the capital facilities plan is measured by the results of executive and legislative action.

ENONOTES

1. For a further discussion of the evolution of modern public budgeting, see: Alan Walter Steiss, Public Budgeting and Management (Lexington, Mass.: D.C. Heath and Company, 1972), chapter 7.

2. Advisory Commission on Intergovernmental Relations, State Technical Assistance to Local Debt Management, Report M-26 (Washington, D.C., January 1965), p. 29.

3. Ibid., p. 29.

4. According to Musgrave, this principle is particularly important in municipal finance "where the composition of the resident group is subject to more or less frequent change". (Richard A. Musgrave, The Theory of Public Finance (1959), p. 563) An elderly person who becomes a resident in a locality which, soon thereafter, makes large expenditures for durable items, financed on a "pay-as-you-go" basis, would be treated inequitably.

5. Robert E. Coughlin, "The Capital Programming Problem", Journal of the American Institute of Planners, 26 (February 1960), p. 39.

6. Roscoe C. Martin, Frank J. Munger, et al., Decisions in Syracuse (Bloomington: Indiana University Press, 1961), p. 15.

CHAPTER 3

LONG-TERM INVESTMENT DECISIONS

Procedures for analyzing long-term investments in fixed capital projects have been widely applied in business and industry for over fifty years. Long-term investment decisions in the private sector focus on four basic areas:

(1) Techniques of operations research applied to determine when it is more efficient (i.e., more profitable) to replace existing equipment rather than repair and maintain it;

(2) Cost-saving investments designed to increase efficiency, to replace outmoded procedures, to modernize facilities, to acquire land for future expansion, and so forth;

(3) Investments in internal and external diversification, new product lines, and research and development operations; and

(4) Investments dictated by external forces such as competition or by public regulations.

The principal objective of such investments is the maximization of profits, i.e., to obtain the maximum return on stockholders' investments. Industries frequently average as much as 50 percent of their total resources in long-term investment commitments. Much of this, of course, is involved in the development of an appropriate cash flow (annual profit margin) and in routine replacement. Factors affecting private sector investment decisions include: (a) the overall philosophy of management (conservatism versus risk-taking), (b) market analysis and forecasting (many firms have a larger planning staff than many major cities), (c) the decisions of competition -- a certain amount of "keeping up with the Joneses" prevails, (d) sources of funding and the cost of capital, (e) the level of working capital available, (f) the effects of inflation, (g) the degree of risk and uncertainty perceived in the marketplace, and (h) governmental policies, particularly tax and depreciation allowances.

Investment decisions in the private sector may be based on several forms of benefit investment analysis. Each of these methods, however, have evident shortcomings and, therefore, are relatively limited in their application to the analysis of long-term public investments: (1) none of these methods takes proper account of the timing of proceeds; (2) unequal dollars are treated as equal; (3) income received after the initial payback is largely ignored in these calculations. In spite of these shortcomings, however, it has been estimated that over seventy percent of the major firms in the country still use one or more (or some combination) of these techniques of benefit investment analysis, coupled with hunches and guesswork.

When it was found that intuitive models, developed in an era of easy profits through rapid industrial expansion, were no longer applicable, however, new tools and concepts began to be introduced in the mid-fifties in the private investment decision process. These new methods are generally classified as discounted cash flow techniques, since they apply the principles of compound interest in a way that takes into account the differences in the worth of money over time. Each method also uses as input data the future negative and positive cash flows of money consequent to particular investments that are required to produce the desired returns.

The following case study illustrates the application of several discounted cash flow techniques in guiding long-term investment decisions in the private sector. The scenario that draws upon these methods is designed to suggest possible transfers to public sector decisions.

Case Study #1: Long-Term Investment Decisions

The XYZ Corporation, in analyzing the possible expansion of one of its manufacturing plants, determined that an initial investment in new capital facilities of $1,200,000 would increase the production capabilities of this plant sufficiently to yield an increase in annual average gross income of $5,300,000 over the next ten years. Projected annual administrative costs, cost of plant operation and maintenance, production and sales expenses, and overhead costs to achieve this increased production were estimated at $5,000,000 (thereby providing a net annual income of $300,000, exclusive of the amortization of the initial investment for the plant expansion). It was estimated that ten years hence the salvage value of the expanded facilities would be only $100,000.

A second alternative under consideration was to more than double the initial investment in plant expansion ($2,500,000) by adopting various production automation techniques. It was estimated that this second alternative would increase the annual average gross income by $5,500,000, while incurring the same level of annual production costs ($5,000,000) to yield an annual net profit of $500,000 (exclusive of amortization of initial investments). The salvage value of the plant expansion ten years hence under this alternative was estimated to be $180,000.

Benefit Investment Analysis

Using various traditional techniques of benefit investment analysis, such as (1) net cash proceeds, (2) cash payback period, and (3) proceeds per dollar of outlay, the corporation management was unable to reach a satisfactory conclusion as to which of the alternatives to adopt. Under the net cash proceeds approach, it was calculated that Alternative A would yield $1,800,000 over the ten year life cycle of the project (i.e., 10 times $300,000 minus $1,200,000), whereas Alternative B would yield $2,500,000

during this period (i.e., 10 times $500,000 minus $2,500,000). Using the technique of cash payback period, however, Alternative A would return the initial investment in four years, whereas five years would be required to recoup the initial investment under Alternative B. The proceeds per dollar of outlay approach also favored Alternative A, since it would return $2.50 for every $1.00 invested ($3,000,000 divided by $1,200,000), whereas Alternative B only returns $2.00 on each $1.00 invested ($5,000,000 divided by $2,500,000). Two other traditional techniques of benefit investment analysis -- average income on book value and average annual proceeds per dollar of outlay -- yield equally inconclusive results. The first technique favors Alternative B, while the second favors Alternative A.

In discussing these results, T. Marshall Tech, a management trainee in the XYZ Corporation, pointed out that while many corporations continue to use these methods, they all have serious weaknesses. He suggested that the firm adopt some of the more sophisticated methods that have been developed in recent years as a means of providing a better index for ranking alternative investments. These methods, he explained, are generally known as discounted cash flow techniques and have grown out of efforts by management to get some measure of economic wisdom for investing capital in additional facilities, products, or processes, and the design engineer's desire for a method of measuring the economy of his designs in both construction and use.

Since the corporation's management was unable to reach a decision on the basis of more traditional Benefit Investment Analysis techniques, Tommy Tech was appointed to head a task force to explore the application of various discounted cash flow methods. Tech requested one additional piece of information necessary to the application of these techniques, namely, the rate of interest per annum that the firm would be expected to pay if it borrowed the funds for the initial investment in plant expansion. This figure, he suggested, provides an indication of the minimum rate of return that the firm would want to receive on its capital outlay. With this information, Tommy Tech was able to make the basic calculations necessary to apply various discounted cash flow techniques such as: (1) equivalent uniform annual net return, (2) net present value, and (3) benefit/cost ratio.

Discounted Cash Flow Methods

It was suggested that the annual interest rate on funds borrowed to finance Alternative A might run around 7.5 percent, whereas Alternative B, having a slightly higher risk, might require an interest rate of 8 percent per annum on borrowed monies. With these data, Tommy Tech calculated the following multipliers used in discounted cash flow methods:

(1) Capital Recovery Factory (CR): $\frac{i(1 + i)^n}{(1 + i)^n - 1}$

Alternative A

$$\frac{.075(1.075)^{10}}{(1.075)^{10} - 1} = \frac{0.1545773}{1.0610313} = 0.1456859$$

Alternative 8

$$\frac{.08(1.08)^{10}}{(1.08)^{10} - 1} = \frac{0.1727139}{1.1589247} = 0.1490294$$

The capital recovery factor provides a multiplier to determine an appropriate amortization of an initial capital investment (I) over a specified time period at a given rate of return (or interest rate) per annum.

(2) Present Worth Factor (PW): $\frac{1}{(1 + i)^n}$

Alternative A

$$\frac{1}{(1.075)^{10}} = 0.4851939$$

Alternative 8

$$\frac{1}{(1.08)^{10}} = 0.4631935$$

The present worth factor is a basic discount factor for determining the present value of some cost or benefit that will accrue at n years in the future (such as the salvage value of a capital construction project).

(3) Present Worth of a Series (SPW): $\frac{(1 + i)^n - 1}{i(1 + i)^n}$

Alternative A

$$\frac{(1.075)^{10} - 1}{0.75(1.075)^{10}} = \frac{1.0610313}{0.1545773} = 6.8640822$$

Alternative 8

$$\frac{(1.08)^{10} - 1}{.08(1.08)^{10}} = \frac{1.1589247}{0.1727139} = 6.7100853$$

The present worth of a series factor provides a multiplier for determining the present value of a uniform series of costs or benefits accrusing over n years. Note that the present worth of a series factor is the reciprocal of the capital recovery factor.

(4) Sinking Fund Factor (SF): $\frac{i}{(1 + i)^n - 1}$

Alternative A

$$\frac{.075}{(1.075)^{10} - 1} = 0.0706859$$

Alternative 8

$$\frac{.08}{(1.08)^{10} - 1} = 0.0690295$$

The sinking fund factor provides a multiplier for determining the annual level of investment necessary to accrue a given sum n years in the future when the funds are invested at a given rate of interest (i).

Having calculated these basic multipliers, Tommy Tech was able to proceed to the actual analysis of the two investment alternatives. He first examined the equivalent uniform annual net return. This method combines all investment costs and all annual expenses into one single annual sum that is equivalent to all disbursements during the analysis period if spread uniformly over the period. To this figure is added an income factor or benefit factor. The alternative having the greatest equivalent uniform annual net return is the best investment.

EUANR = -I(CR) + T(SF) - K + R

where I is the initial investment, T is the terminal or salvage value, K is the annual costs of production, and R is the annual returns or gross profits (R - K equals net profits).

Alternative A

EUANR = -$1,200,000(0.1456859) + $100,000(0.0706859) + $300,000

= -$174,823.08 + $7,068.59 + $300,000

= $132,245.51

Alternative B

EUANR = -$2,500,000(0.1490294) + $180,000(0.0690295) + $500,000

= -$372,573.50 + $12,425.31 + $500,000

= $139,851.81

The result of the application of this method suggested that Alternative B was the more favorable investment since it yielded the larger equivalent uniform annual net return.

The second set of calculations focused on the net present value of the investment alternatives. This method provides the algebraic difference in the present worths of both outward cash flows and inward flows of incomes or benefits. The alternative having the greater net present value is the best investment.

NPV = -I + T(PW) + (R - K) (SPW)

Alternative A

NPV = -$1,200,000 + $100,000(0.4851939) + $300,000(6.8640822)

= -$1,200,000 + $48,519.39 + $2,059,224.60

= $907,743.99

Alternative B

$$NPV = -\$2,500,000 + \$180,000(0.4631935) + \$500,000(6.7100853)$$

$$= -\$2,500,000 + \$83,374.83 + \$3,355,042.60$$

$$+ \$938,417.43$$

Again, the results of this analysis favored Alternative B, since it had the larger net present value.

To provide further vertification, a benefit/cost ratio was calculated to compare the two alternatives. The benefit/cost ratio method expresses the ratio of equivalent uniform annual benefits (or its present worth) to the equivalent uniform annual cost (or its present worth). Any alternative that has a benefit/cost ratio above 1.0 is economically feasible and the alternative that has the highest incremental benefit/cost ratio is indicated as the preferred approach.

$$B/C = \frac{K - R}{-I(CR) + I(SF)}$$

Alternative A

$$B/C = \frac{\$5,000,000 - \$5,300,000}{-\$1,200,000(0.1456859) + \$100,000(0.0706859)}$$

$$= \frac{-\$300,000.00}{-\$167,754.57}$$

$$= 1.78832$$

Alternative B

$$B/C = \frac{\$5,000,000 - \$5,500,000}{-\$2,500,000(0.1490294) + \$180,000(0.0690295)}$$

$$= \frac{-\$500,000.00}{-\$360,148.19}$$

$$= 1.38832$$

Much to the surprise of all concerned, Alternative A produced the higher benefit/cost ratio. Did this mean that the corporation was back where it started before Mr. Tech suggested the use of discounted cash flow methods to analyze these two alternatives? The results of these three analyses still appeared to be contradictory.

Mr. Tech was quick to point out that it is sometimes fallaciously assumed that a project alternative ranked first in terms of net present value (or net benefits) will also rank first in terms of its benefit/cost ratio -- that these techniques are readily interchangeable. The fact that the net present value of Alternative B was greater than the net present value of Alternative A does not imply that the benefit/cost ratio of B will be greater than the benefit/cost ratio of A. Net present value measures difference, whereas benefit-cost calculations produce a ratio. To illustrate this point further, assume that the benefits of one alternative have a present value of $50,000. The net present value of this alternative would be $100,000 and the benefit/cost ratio would be $150,000/$50,000 or 3.0. Assume that a second alternative has a present value of benefits of $100,000 and that of costs $20,000. This second alternative has a smaller net present value ($80,000), but a higher benefit/cost ratio ($100,000/$20,000 or 5.0). Knowing the benefit/cost ratio for a given alternative is not sufficient; it is also necessary to know the size of the project before as much information is available as is given in the present value of net benefits.

Alternative B yields an equivalent uniform annual net return of $139,851.81, which is $7,606.30 greater than Alternative A. If this amount were to be invested each year as it was earned, returning eight percent compound interest, it would provide an additional $164,214.50 to the firm over ten years. Therefore, it was determined that Alternative B would provide the better investment opportunity for the XYZ Corporation.

Scenario #1: Long-Term Investment Decisions

The Rurbania Sewer and Water Authority currently has under consideration two alternative approaches to the expansion of its sewage collection and treatment facilities to service a recently annexed residential area. Existing homes in this area are presently served for the most part by individual septic systems or "package plant" installations.

The first alternative under consideration involves a minimum expansion of current facilities to service an additional 1,400 residential units.[1] This alternative would require an initial investment of $300,000, with annual administrative, operations, and maintenance costs estimated at $14,000. The Authority proposes to float special assessment bonds with a 15-year maturity at an annual interest of 8 percent in order to finance this project. The total debt service on this project (principal and interest charges) would be $492,000. Debt service calculations are based on a straight serial (declining principal) bond with equal annual principal payments.[2] The estimated terminal value for the expansion facility at the end of fifteen years is $40,000. The Authority proposes to levy a monthly user fee of $3.00 to finance this project (resulting in an average annual income from user fees of $50,400).

The second alternative, involving more extensive capacity (potentially 1,800 residential units served annually) and certain new treatment techniques,

would require an additional investment of $100,000 over the first alternative. Annual administrative, operations, and maintenance costs are estimated to be $16,000. As with the first alternative, it would be necessary for the Authority to issue special assessment bonds (15-year maturity at 8 percent), resulting in a total debt service of $656,000. The estimated terminal value of this alternative (after 15 years) is $50,000. The Authority would finance the project costs through a monthly $3.00 user fee, resulting in estimated average annual revenues of $64,800.

The pertinent cash flow data for these two alternatives are summarized in Table 3-1. Using the discounted cash flow techniques discussed in the previous case study (equivalent uniform annual net return, net present value, and benefit/cost ratio), the scenario assignment is to determine which of these project alternatives is preferable. It first will be necessary to calculate the appropriate multipliers, using the formula provided in the case study.

Table 3-1. Cash Flow Data for Rurbania Analysis

Cash Flow Items	Alternative I	Alternative 2
I = Initial Investment	$300,000	$400,000
O = Oebt Service	$492,000	$656,000
T = Terminal Value	$ 40,000	$ 50,000
A = Annual Administrative Cost	$ 2,000	$ 2,000
J = Annual Operations Cost	$ 6,000	$ 4,000
M = Annual Maintenance Cost	$ 6,000	$ 10,000
K = Total of A. J., & M	$ 14,000	$ 16,000
R = Annual Income from User Fees	$ 50,400	$ 64,800
i = Rate of Interest per Annum	8%	8%
n = Analysis Period	15 yrs.	15 yrs.

Based on this analysis, which alternative would you recommend to the Rurbania Sewer and Water Authority? What is the minimum number of annual users required under this recommended alternative in order for the Authority to "break even" on the project?

Instruction Guide #1: Long-Term Investment Decisions

The appropriate multipliers to be used in solving the formula required by the scenario are as follows:

Capital Recovery Factor = 0.1168295

Present Worth Factor = 0.3152417

Present Worth of a Series Factor = 8.5594798

Sinking Fund Factor = 0.0368295

The first question to be resolved is which figure should be used for the capital cost of the project: the initial investment cost or the debt service cost. It may be argued that the real cost to the Authority is not the initial investment cost ($300,000 and $400,000 respectively) but the cost of borrowing these funds at 8 percent. This point might be discussed with the workshop participants before they begin their calculations. While there may be strong support among the participants to use the debt service costs ($492,000 and $656,000 respectively), the appropriate figure is I. This can be shown in the calculations of net present value. Since the Authority is making debt service payments over a fifteen year period (fixed principal plus interest on the unpaid principal), these payments would have to be discounted to present worth in order to determine net present value. The $492,000 in total debt service for Alternative 1, for example, has a present worth of $300,000, while the $656,000 in debt service for Alternative 2 has a present worth of $400,000. Therefore, I and not O should be used in making these calculations.

If D is used in these formulas, all values will be negative, as shown in the examples below:

Alternative 1

EUANR = -$492,000(0.1168295) + $40,000(0.0368295) + $36,400.

= -$57,480 + $1,473.18 + $36,400

= -$19,606.82

NPV = -$492,000 + $40,000(0.3152417) + $36,400(8.5594798)

= -$492,000 + $12,609.67 + $311,565.06

= -$167,825.27

$$B/C = \frac{\$36,400}{\$56,007} = 0.6499$$

However, using I in the formula, the appropriate calculations are as follows:

Alternative 1

EUANR = -$300,000(0.1168295) + $40,000(0.0368295) + $36,400

= -$35,048.85 + $1,473.18 + $36,400

= $3,824.33

NPV = -$300,000 + $40,000(0.3152417) + $36,400(8.5594798)

= -$300,000 + $12,609.67 + $311,565.06

= $24,174.73

$$B/c = \frac{\$36,400}{\$33,576} = 1.0841$$

Alternative 2

EUANR = -$400,000(0.1168295) + $50,000(0.0368295) + ($64,800 - $16,000)

= -$46,731.80 + $1,841.48 + $48,800

= $3,909.68

NPV = -$400,000 + $50,000(0.3152417) + $48,800(8.5594798)

= -$400,000 + $15,762.09 + $417,702.61

= $33,464.70

$$B/C = \frac{\$48,800}{\$44,890} = 1,0871$$

From these calculations, it may be determined that Alternative 2 is the preferred approach, even though the benefit/cost ratios for the two alternatives are nearly identical.

To determine the "break even point" for Alternative 2, it is necessary to calculate total costs to be incurred by the Authority. Here it would be appropriate to use debt service costs.

Annual Costs = $16,000 x 15 = $240,000
Debt Service Costs = 656,000
$896,000

This figure divided by 15 gives the annual average cost or $59,733.33.

Since each user will be charged $3 times 12 or $36 per year, dividing $59,733.33 by $36 will yield the "break even" number of users = $1,660.

ENDNOTES

1. To simplify the scenario calculations, the 1,400 and 1,800 residential units to be served by the two alternatives represent annual average figures, projected over the anticipated life of the project.

2. For a further discussion of this and other forms of bonding, see chapter 6.

CHAPTER 4

POPULATION ESTIMATES ANO PROJECTIONS

The establishment of goals and objectives for public service programs and the determination of desirable standards of service for carrying out these programs are essential elements in capital facilities planning. Standards of service often are delimited in measurable, quantitative terms. For example, standards for public open space can be expressed in terms of acres per given unit of population and/or in terms of optimum times or distances required for residents to travel to enjoy various forms of recreational experiences. Health care standards often can be expressed in terms of medical personnel and/or hospital beds per thousand population; educational facilities in terms of classroom-pupil ratios; library facilities in terms of client capacity and time-distance factors; and so forth. While many standards are more difficult to quantify, those that can be measured provide important means of assessing existing public facilities and programs in light of desired objectives and population/client groups to be served.

To translate standards of service into future capital needs, it is necessary to have well-founded estimates of future population, including demographic and geographic distribution. Projective computations were introduced in the field of demography only a few decades ago, and as Roland Pressat, the noted French demographer, has observed, until very recently these projects (frequently known as "conditional forecasts") have had no predictive pretensions.

> . . . they simply illustrate the effect on a population (on its total or its age and sex composition) of the operation of certain fertility and mortality conditions, chosen for specific purposes --whether they be hypotheses whose realization is doubtful or hypotheses singled out because they represent extreme situations between which the real situations seem certain to take place.[1]

In short, demographers (and planners following after the techniques of demography) have made liberal use of the concept of a range of projections in lieu of more definitive estimates of future population characteristics for a given study area. Unfortunately, such future population parameters often are extrapolated from current data with insufficient detail to be of much utility to the capital facilities planner. The statement that the population of community X in 1985 will be between 150,000 and 175,000 does not provide an adequate basis for the development of capital facilities commitments.

Age-Cohort Projections

For purposes of capital facilities planning, it is necessary to develop fairly detailed estimates and projections of population by age-cohorts. Such detail is particularly applicable to the identification of capital facility needs associated with certain age groups (such as school facilities, health care facilities, housing for the elderly, recreational needs, etc.).

Materials presented in the case study which follows are designed to illustrate methods that can be used to derive such projections. While these techniques require the adoption of a number of assumptions (and therefore, are only as accurate and valid as are these assumptions), the capital facilities planner has little or no choice but to make the best of the data available. These calculations and their associated assumptions become particularly problematic in intercensual years when the analysis moves further away from a sound data base.

Knowledge about current demographic conditions in the target community provides a critical starting point upon which to build the assumptions that will influence future estimates and projections. Of particular importance is an understanding of the social characteristics of the population (e.g., average household size, average income, racial and ethnic mix, median years of education, etc.).

An understanding of the community's economic base and trends evident in the local economy also provides important inputs to the development of assumptions for future population estimates. Employment and occupational characteristics, as well as the economic base structure of the area, should be used as indicators of possible shifts in factors which condition future demographic characteristics. For example, demographers are predicting a continual decline nationally in fertility rates, reflecting the widespread use of birth control devices, later family formation practices, increased involvement of women in the labor force, and the overall conditions of the economy. The extent to which these factors may be present in a given local economy may influence the assumptions applicable to future population estimates.

Case Study #2: Population Estimates for City of Rurbania

Woodley Blueridge, a senior planner in the Department of Planning and Budget, was given principal responsibility for the development of current intercensual population estimates for the City of Rurbania. These estimates, in turn, will provide a basis for future population projections in conjunction with the city's capital facilities planning efforts. Rurbania is an emerging metropolitan center (having reached the 50,000 level of population some twenty years previously), with a fairly diverse economic base (light manufacturing and fabrication, regional retailing and wholesaling, professional services, etc.), serving as a regional center for various insurance companies and as a site of a major four-year state university. Its population is largely middle to upper-middle income families, whose heads of households work in the white-collar industries or as associated with the university. Rurbania is located beyond the immediate influence of other metropolitan centers and serves as a regional trade center for the surrounding rural areas. Most suburban residential areas have been annexed to the city as they emerged, although there are

some scattered residential areas in the surrounding rural county. In short, Rurbania is a "free-standing" metropolitan center (albeit relatively small).

Table 4-1. Age-Sex Cohorts: City of Rurbania

Cohorts	Totals	Males	Females	Ten Years Previously
All Ages	76,660	39,076	37,584	60,396
Under 5	6,047	3,048	2,999	6,626
5 to 9	6,782	3,474	3,308	5,513
10 to 14	6,706	3,431	3,275	4,935
15 to 19	7,543	4,842	2,701	4,668
20 to 24	9,689	5,528	4,161	5,682
25 to 29	6,398	3,235	3,163	4,579
30 to 34	4,608	2,290	2,318	4,104
35 to 39	4,124	1,984	2,140	4,061
40 to 44	4,233	2,125	2,108	3,528
45 to 49	4,081	1,987	2,094	3,337
50 to 54	3,564	1,689	1,875	3,125
55 to 59	3,239	1,515	1,724	2,729
60 to 64	2,939	1,299	1,640	2,142
65 to 69	2,400	1,029	1,371	1,963
70 to 74	1,776	734	1,042	1,511
75 to 79	1,272	482	790	957
80 to 84	757	236	521	548
85 & over	502	148	354	388
Under 18	23,165	11,808	11,357	19,554
65 & over	6,707	2,629	4,078	5,367
Median age	26.1	24.1	28.6	27.9

Mr. Blueridge began his assignment by gathering available information about the city's population from the most recent Census (completed five years previously). As shown in Table 4-1, Rurbania experienced considerable growth in the intercensual period for which comparative data were available. During these ten years, the city's population increased by 26.93 percent, rising from 60,396 to 76,660. This compares to a 17.2 percent increase in the State's population during this same period.

Perhaps as significant as the overall increase in population is the change in the population composition. The population of Rurbania is becoming younger, with a shift in the median age from 27.9 years to 26.1 years. Usually such a shift is a reflection of larger number of children being born into the subject population. However, as shown in Table 4-2, there were fewer children under five years of age in the most recent census than ten years previously. The overall increase in the under 18 category was only 18.5 percent, while the over 65 age group increased by 24.97 percent, close to the overall rate of increase of the total population.

Table 4-2. Net and Percentage Changes in Age Cohorts

Cohorts	Net Change	Percentage Change	Net Change in Surviving Cohorts*
All Ages	16,264	26.93%	--
Under 5	-579	-8.74	--
5 to 9	1,269	23.02	--
10 to 14	1,771	35.89	80
15 to 19	2,875	61.59	2,030
20 to 24	4,007	70.52	4,754
25 to 29	1,819	39.72	1,730
30 to 34	504	12.28	-1,074
35 to 39	63	1.55	- 455
40 to 44	705	19.98	129
45 to 49	744	22.30	20
50 to 54	439	14.05	36
55 to 59	510	18.69	- 98
60 to 64	797	37.21	- 186
65 to 69	437	22.26	- 329
70 to 74	265	17.54	- 366
75 to 79	315	32.92	- 691
80 to 84	209	38.14	- 754
85 & Over	114	33.73	-1,391
Subtotal			3,435
Under 10			12,829

*Number of persons in a given cohort minus the number of persons in a ten year younger cohort ten years previously

In examining the data in Table 4-2, Blueridge noted that the 15 to 19 age cohort showed an increase of 61.59 percent, while the 20 to 24 cohort recorded a phenomenal 70.52 percent increase. These two cohorts added 6,784 persons to the population of Rurbania, whereas the total increase in

population (births minus deaths plus migration) was 16,264. In other words, 41.5 percent of the increase in population was accounted for by increases in these two cohorts. Blueridge reasoned that the overall increase in the enrollment at the university, coupled with the growth of the local economy which afforded job opportunities for younger members of the labor force, accounted for the significant increase in the 15 to 29 age group (and consequently, the lowering of the median age in Rurbania).

The Components of Demography

Demography is essentially a study of additions to and subtractions from a population. The basic demographic formula is relatively simple:

$$P_2 = P_1 + (B - D) + (IM - OM).$$

Setting aside for the moment the question of migration, the remaining factors of fertility (births) and mortality (deaths) are the essential components of demographic analysis. Since raw numbers seldom are adequate to serve as a basis for projections, these usually must be converted into rates in order to make possible the comparison between two or more populations at different points in time.

The most common measures of fertility and mortality are the crude birth and the crude death rates, which are defined as equal to:

$$\frac{\text{Number of births (or deaths) per year X 1000}}{\text{Total Population}}$$

In order to secure a measure of population increase or decrease (ignoring migration), it is only necessary to combine these rates. Thus, the crude birth rate minus the crude death rate yields the crude rate of natural increase.

Blueridge determined that the crude birth rate for Rurbania was 21.24 per 1000 and the crude death rate, 9.46 per 1000. On this basis, he calculated that the population of Rurbania might be expected to grow through natural increase from the census level of 76,660 to an estimated level of 81,203 five years later, as illustrated below.

Year	Total Population	Death Rate 9.46/1000	Birth Rate 21.24/1000
0	76,660	725	1,613
1	77,548	734	1,632
2	78,446	742	1,650
3	79,354	751	1,670
4	80,273	759	1,689
5	81,203		
Diff.	4,543	3,711	8,254

Blueridge next assumed that the growth rate of the ten year census period would continue through the next five years, and thereby calculated that the population should reach approximately 86,368. He arrived at this figure by taking the square root of the percentage increase in population over the ten year census period (i.e., $(1.2693)^{\frac{1}{2}}$) which equals 1.1266321, which he then multiplied times 76,660 = 86,368. Taking the square root provides an estimate of the effective rate of increase for the five year period (the tenth root would provide an annual effective rate of increase). Since the figure of 26.93 percent represents an accumulative rate of growth over a ten year period, it is not possible to determine an annual rate of increase by merely taking one-tenth of this figure.

Blueridge considered the difference between these two estimates to be the consequence of in-migration, i.e., approximately 5,165 people are estimated to be added to the population since the last census through net migration. This figure represents 53.2 percent of the total estimated growth, which is approximately the portion of increase accounted for by net migration during the ten years of the previous census period.

While crude birth and death rates provide some notion as to the rapidity with which the population is changing, they do not reveal whether these are really high or low in light of potentials for births and deaths. If such an estimate is desired, the crude rates must be refined by adjusting for a more accurate base. Since the crude rate is computed on the basis of the total population, it includes components which may be differently represented in two or more populations and also be correlated with fertility or mortality.

Only women bear children; therefore, men should be dropped from the denominator of the crude calculations of fertility. Furthermore, not all females can be expected to bear children, since some are too young and some too old (despite the song "You're never too young or too old.") The conventional adjustment for this factor is to include the period between ages 15 and 44. The specific <u>birth rate</u> (sometimes called the fertility rate) is equal to:

$$\frac{\text{Number of children born per year X 1000}}{\text{Number of women 15 to 44 in the population}}$$

This rate, of course, may be further refined by any other factor of significance to a particular projection, e.g., race, nationality, marital status, rural-urban residence, or specific age-cohorts.

The same general principle of course, also applied to the refining of mortality rates. In this case, however, age is the fundamental refinement, although sex is often included since mortality rates of the sexes differ. Unlike the case of specified birth rate, there is no conventional procedure for the computation of a specific mortality rate. The problem is usually solved by the application of a standarized rate,

through the use of so-called "life tables". These tables are compiled by actuaries and demographers to represent the life expectancy for different age groups in a given population (broken down on a regional basis by sex, and by other relevant characteristics). Thus a life table provides a means of treating the age-specific mortality rates (i.e., mortality rates for definite age categories) of a population in such a way as to show what the mortality experience of a cohort would be throughout its collective lifetime (assuming age-specific mortalities remain unchanged). The life table is essentially a straightforward process of cumulative subtraction. The construction of the table merely consists of reducing a given cohort by age-specific mortalities until the last individual member disappears.

Construction of a Life Table for Rurbania

After examining several standardized life tables, Woodley Blueridge concluded that it would be more appropriate to construct a specific life table for Rurbania. The following component information is required for the construction of such a table:

(1) Age interval (x) and interval size (n)

(2) Population (P) in base year

(3) Number of deaths (D) in base year

(4) Mortality rate ($_nm_x$) which is equal to (3) divided by (2)

(5) Probability of dying ($_nq_x$)

(6) Survival rate ($_ns_x$) which is equal to 1.0 minus (5)

(7) Number (of a hypothetical population, usually set at 100,000) entering each interval (l_x)

(8) Number dying in each interval ($_nd_x$) which is equal to (7) times (5)

(9) Number of years lived in each interval ($_nL_x$) which is equal to (8) divided by (4)

(10) Number of years lived in each interval and all succeeding intervals (T_x); the summation of data in column 9

(11) Life expectancy at age x ($_e0_x$) which is equal to (10) divided by (7).

Application of these data requirements for the City of Rurbania is shown in Table 4-3. To illustrate the calculation procedures applied by Blueridge, follow the population of 6,706 in the age cohort 10 to 14. Blueridge determined from local vital statistics that three persons died in this age cohort during the base year; therefore, the mortality rate is approximately 0.000447. According to Reed-Merrell Actuary Tables, the probability of dying for this age cohort (given this mortality rate) is 0.002230.

Table 4-3. Construction of an Abridged Life Table for the City of Rurbania--Using Reed-Merrell Tables

(1) X Age Interval	(2) P Base-Year Population	(3) D Number of Deaths, Base-Year	(4) $_nm_x$ Mortality Rate (3 ÷ 2)	(5) $_nq_x$ Probability of Dying (Reed-Merrell Tables)	(6) $_ns_x$ Survival Rate (1 -(5))
Under 1	1143	33	0.028871	0.025695	0.974305
1-4	4904	4	0.000816	0.004071	0.995929
5-9	6782	3	0.000442	0.002205	0.997795
10-14	6706	3	0.000447	0.002230	0.997770
15-19	7543	7	0.000928	0.004630	0.995370
20-24	9689	12	0.001239	0.006176	0.993824
25-29	6398	9	0.001407	0.007010	0.992990
30-34	4608	8	0.001736	0.008643	0.991357
35-39	4124	10	0.002425	0.012055	0.987945
40-44	4233	16	0.003780	0.018735	0.981265
45-49	4081	24	0.005881	0.029010	0.970990
50-54	3564	33	0.009259	0.045320	0.954680
55-59	3239	45	0.013893	0.067286	0.932714
60-64	2939	62	0.021096	0.100507	0.899493
65-69	2400	75	0.031250	0.145487	0.854513
70-74	1776	83	0.046734	0.210103	0.789897
75-79	1272	91	0.071541	0.304288	0.695712
80-84	757	89	0.117569	0.452101	0.547899
85-89[a]	371	71	0.191375	0.629720	0.370280
90-94[a]	108	35	0.324074	0.821897	0.178103
95-99[a]	20	9	0.450000	0.913922	0.086078
Over 100[a]	3	3	1.000000	1.000000	--
Total	76660	725			

[a]These value are secured by distributing the number of those 85 and over in the same proportions are found in the life table population for the United States, 1970.

Table 4-3. (cont.) Abridged Life Table for the City of Rurbania

X Age Interval	(7) l_x Hypothetical Number Entering Each Interval	(8) $_nd_x$ Number Dying in Each Interval (7 x 5)	(9) $_nL_x$ Number of Years Lived in Each Interval (8 ÷ 4)	(10) T_x Number of Years Lived in Interval and all Succeeding Intervals	(11) e^0_x Life Expectancy at Age X (10 ÷ 7)
Under 1	100,000	2570	98,139[b]	6,975,277	69.75
1-4	97,430	397	388,703[c]	6,877,138	70.59
5-9	97,033	214	484,856[d]	6,488,435	66.87
10-14	96,819	216	483,221	6,003,579	62.01
15-19	96,603	447	481,681	5,520,358	57.14
20-24	96,156	594	479,419	5,038,677	52.40
25-29	95,562	670	476,190	4,559,258	47.71
30-34	94,892	820	472,350	4,083,068	43.03
35-39	94,072	1134	467,629	3,610,718	38.38
40-44	92,938	1741	460,582	3,143,089	33.82
45-49	91,197	2646	449,823	2,682,507	29.41
50-54	88,551	4013	433,416	2,232,584	25.21
55-59	84,538	5688	409,415	1,799,168	21.28
60-64	78,850	7925	375,664	1,389,753	17.63
65-69	70,925	10319	330,208	1,014,089	14.30
70-74	60,606	12733	272,457	683,881	11.28
75-79	47,873	14567	203,618	411,424	8.59
80-84	33,306	15058	128,078	207,806	6.24
85-89	18,248	11591	60,044	79,728	4.37
90-94	6,757	5554	17,138	19,684	2.91
95-99	1,203	1099	2,442	2,546	2.12
Over 100	104	104	104	104	--

[b] $_1L_0 = 0.276(100,000) + 0.72(97,430)$

[c] $_4L_1 = 0.034(100,000) + 1.184(97,430) + 2.782(97,033)$

[d] $_5L_5 = 0.003(100,000) + 2.245(97,033) + 2.761(96,819)$

The reason that the probability of dying ($_nq_x$) is not the same as the mortality rate ($_nm_x$) is that the mortality rate has as a base an observed population within which all living persons of a particular age group are counted. The life-table population, however, is a cohort analysis. Thus the deaths between, say, age 5 and 9 will reduce the life-table base at each year. To apply the mortality rate to the entire number entering the age group, therefore, would understate the actual number of deaths in the cohort and thus, reduce the probability of dying. This factor is true for all ages except 0 to 1, where because of the skewed character of the age distribution of deaths, the mortality rate overstates the probability of dying. Reed-Merrell Tables [2] were developed to provide the corrections of mortality rates necessary for accurate probabilities of dying values. Over the years, these tables have become the accepted standard for demographic analysis.

The computed survival rate for the 10 to 14 cohort is 0.997770 (i.e., 1.000000 minus 0.002230). Survival rates are of particular importance to the subsequent estimates that Blueridge made. By applying the survival rate to each cohort, the population in that cohort in the base year can be "stepped up" to the next appropriate cohort(s). For example, of the 6,706 persons in the 10 to 14 age cohort in the base year (with a survival rate of 0.997770), 6,691 may be expected to survive to the 15 to 19 age cohort. If this cohort maintains the survival rate of 0.995370, then 6,660 may be expected to survive to the 20 to 24 age cohort, and so forth.

For the purposes of his analysis, Blueridge could have concluded his calculations at this point. However, he continued the procedures to complete the life table. Applying the data, it may be seen that of the 100,000 hypothetical people entering the population, 96,819 "survived" to age 10-14. By applying the probability of dying factor (0.0022300) to this surviving population, it is expected that 216 will die while in this cohort. The number of years lived in each interval for the 10 to 14 cohort is 216 divided by 0.000447 (i.e., the mortality rate) or 483,221. After calculating a similar figure for each successive cohort, these data were summed; as shown in Table 4-3, the cummulative sum to the 10 to 14 age cohort is 6,003,579. Dividing this number by the number of people entering the 10 to 14 cohort (i.e., 96,819) produced a Life Expectancy for the cohort of 62.01 years.

Life tables, in general, provide conservative estimates of life expectancy, since undernumeration exaggerates mortality, and since the assumption that mortality will remain constant is not warranted. Actually, mortality in most age categories decreases during the lifetime of a cohort.

Table 4-4. Fertility Ratio and Number of Children Under 5 Years of Age Per 1000 Women 15 to 44: Rurbania

Women Ever Married	Fertility Ratio	Number of Children Under 5 Years of Age Per 1000 Women
15 to 24	905	270
25 to 34	2191	584
35 to 44	2921	181

The final data set that Woodley Blueridge required for his initial population estimates was the fertility ratio of women in Rurbania in the base year and the number of children under five years of age per 1000 women. These statistics are shown in Table 4-4.

Blueridge made an initial 5-year population estimate without migration as shown in Table 4-5. In this estimate, he used the survival rates calculated in the construction of the life table to "step-up" the various five year cohorts and applied the fertility rate (number of children under 5 years of age per 1000 women) to determine the number of children born in this five year period. Note that the surviving population without new births was 73,680, or 3.89 percent lower than the base year population. However, the 6,656 new children born in the five year period resulted in a population increase of 4.8 percent. In calculating the number of females in the various child bearing age groups five years beyond the base population point, Blueridge assumed that the ratio of males to females in the respective age cohorts would remain constant.

Migration

The problem of securing an accurate measure of internal migration is very complex and one which is not yet systematized in the way that the measures of fertility and mortality have been. Therefore, this phase of demographic analysis will tax the ingenuity of the researcher who undertakes its study. Several points should be remembered, however.

(1) Migration is generally a function of economic conditions--a growing economy will attract in-migrants; a static or declining economy will produce out-migrants.

(2) Mobility is not equal in all age cohorts--higher rates of migration (both in and out) generally occur in the early years of economic productivity (i.e., the 20 to 29 cohorts).

(3) Young children seldom migrate by themselves--their patterns of migration are a function of their parents.

Table 4-5. Population Estimate (without Migration): City or Rurbania

Age Cohorts Base Year	Population Base Year	Survival Rates	Age Cohorts Plus 5 Years	Surviving Population Plus 5 Years	Child Bearing Females		Fertility Rate	Children Under 5
					Percent Base Year	Number Plus 5 Yrs.		
			Under 5	6656				
Under 5	6047	.991731[a]	5-9	5997				
5-9	6782	.997795	10-14	6767	48.78	3301		
10-14	6706	.997770	15-19	6691	48.84	3268	270	882
15-19	7543	.995370	20-24	7508	35.81	2689	270	726
20-24	9689	.993824	25-29	9329	42.95	4136	584	2415
25-29	6398	.992990	30-34	6353	49.44	3141	584	1834
30-34	4608	.991357	35-39	4568	50.30	2298	181	416
35-39	4124	.987945	40-44	4074	51.89	2114	181	383
40-44	4233	.981265	45-49	4153				
45-49	4081	.970990	50-54	3962				
50-54	3564	.954680	55-59	3402				
55-59	3239	.932714	60-64	3021				
60-64	2939	.899493	65-69	2643				
65-69	2400	.854513	70-74	2051				
70-74	1776	.789897	75-79	1403				
75-79	1272	.695712	80-84	885				
80-84	757	.547899	85-89	415				
85-89	371	.370280	90-94	137				
90-94	108	.178103	95-99	19				
95-99	20	.086078	100 +	2				
100 +	3	--						
Totals	76660			80336		20947		6656

[a]Represents the weighted average of the survival rates for under 1 and 1 to 4.

(4) Communities that have retirement potentials may experience an unusual in-migration at the 65-plus age groups.

Blueridge reasoned that a crude migration rate could be calculated for a given community by determining over a ten year period the expected population without migration (through the methods outlined above) and comparing these statistics with the actual population at the end of that period. Any differences, plus or minus, can be assumed to be a result of migration, and if the consequences that produced these differences can be assumed to hold for the next time period, these crude rates can be applied in making estimates and projections.

Pursuing this approach, Woodley Blueridge developed the population analysis summarized in Table 4-6. He "survived" the age cohorts from ten years prior to the base year data over the census period (note that it was necessary for Blueridge to do two sets of calculations since his calculated survival rates were for five-year periods). These calculations revealed that 55,440 of the initial 60,396 persons "survived" the ten years between censuses, or conversely that 4,956 died.

During this period, 12,829 children were born (or migrated into the city with their parents). This resulted in a "natural increase" of 7,873 (i.e., 12,829 births minus 4,856 deaths). However, the Census data reveals that 16,264 more people were in the City of Rurbania in the base year than ten years previously. Therefore, Blueridge concluded that 8,391 persons were added to the population through "net migration."

Natural Increase	= 7,873	48.4%
Net Migration	= 8,391	51.6%
Total Increase	=16,264	100.0%

It may be argued that this approach to the formulation of net migration factors is built upon a number of assumptions that require careful examination. These assumptions appear to be defensible, however. It is assumed that the survival rates computed for the base year can be applied in calculating the surviving population from ten years previously. Since survival rates in most urban areas such as Rurbania are improving with time, this assumption tends to understate the impact of migration. The elimination of children under ten years of age from the migration flow also tends to underestimate the impact of migration. In short, any errors introduced by this approach are in the same direction and are on the conservative side.

As shown in Table 4-6, Blueridge computed a percentage change through migration figure for each cohort from 10-14 through 80-84 (base year). As with the earlier analysis, he discerned that the largest increases occurred in the younger age cohorts (15 to 29) which is in keeping with the data in Table 4-2. The "out-migrat.on" in the 30 to 34 and 35 to 39 cohorts is not too surprising since these are years of high career mobility. What is somewhat surprising is that there was

Table 4-6. Population Analysis--City of Rurbania, Base Year and Minus Ten Years

Age Cohort Minus 10 Yrs.	Population Minus 10 Yrs.	Cohort Survival Rate	Surviving Population Minus 5 Yrs.	Cohort Survival Rate	Surviving Population Base Year	Age Cohort Base Year	Population Base Year	Net Migration	Percent Change through Migration
						Under 5	6047		
						5-9	6782		
Under 5	6626	.991731	6571	.997795	6557	10-14	6706	149	2.2487
5-9	5513	.997795	5501	.997770	5489	15-19	7543	2054	37.2574
10-14	4935	.997770	4924	.995370	4879	20-24	9689	4810	97.4671
15-19	4668	.995370	4646	.993824	2617	25-29	6398	1781	38.1534
20-24	5682	.993824	5647	.992990	5607	30-34	4608	- 999	-17.5818
25-29	4579	.992990	4547	.991357	4508	35-39	4124	- 384	- 8.3861
30-34	4104	.991357	4069	.987945	4020	40-44	4233	213	5.1901
35-39	4061	.987945	4012	.981265	3937	45-49	4081	144	3.5459
40-44	3528	.981265	3462	.970990	3362	50-54	3564	202	5.7256
45-49	3337	.970990	3240	.954680	3093	55-59	3239	146	4.3752
50-54	3125	.954680	2983	.932714	2782	60-64	2939	157	5.0240
55-59	2729	.932714	2545	.899493	2289	65-69	2400	111	4.0674
60-64	2142	.899493	1927	.854513	1647	70-74	1776	129	6.0224
65-69	1963	.854513	1677	.789897	1324	75-79	1272	- 52	- 2.6490
70-74	1511	.789897	1194	.695712	831	80-84	757	- 74	- 4.8974
75-79	957	.695712	666	.547899	365	85-89	502	4	--
80-84	548	.547899	300	.315400	95	90-94			--
Over 85	388	.315400	122	.315400	38	Over 95			--
Total	60396				55440		76660	8391	

Population, Base Year = Surviving Population + Births + "Net Migration"

= 55,440 + (6,047 + 6,782) + 8,391 = 76,660

Population, Base Year = Population, Minus 10 Yrs. + (Births - Deaths) + "Net Migration"

= 60,396 + (12,829 - 4,956) + 8,391 = 76,660

not a greater increase through migration in the older age groups (over 65), since Rurbania has many qualities to make it an attractive community for retirement (except for the relatively high property values).

To formulate five-year multipliers, Blueridge took the square root of 1 plus the percent change through migration for each cohort. For the under 5 cohort, a weighted average of the "multipliers" for the 15 to 39 cohorts was calculated and then multiplied times 0.5, on the assumption that two adults migrating into the area bring with them one child. The same procedure was used for the 5 to 9 cohort, with the 20 to 44 cohorts providing the weighted base. For cohorts over 70, Blueridge applied the survival rates.

The application of these multipliers resulted in the population estimates shown in Table 4-7. These calculations suggest that between the base year and five years later (the point of Blueridge's estimates) the population increased by 15,245. Of this total, 5,110 (33.5%) was the result of natural increase and 10,135 (66.5%) the consequence of assumed net migration.

Blueridge concluded that these estimates were too high, particularly in view of his previous estimate based on crude birth and death rates. He was also concerned about the disproportionately high percentage of the increase resulting from migration. In particular, he was concerned that the multipliers for the age cohorts, under 5, 5 to 9, and 20 to 24 were too high. A lower set of multipliers for the younger age groups, he felt would more closely reflect the trends in reduced family sizes, postponed family formation, and the greater use of birth control practices. A lower multiplier in the 20 to 24 age cohort, he reasoned, would reflect the slowing trends in college enrollments and in employment opportunities within the City of Rurbania for younger members of the labor force.

With this reasoning, Blueridge prepared a revised population estimate, as shown in Table 4-8, with scaled down multipliers for most cohorts. This estimate showed a 13.7 percent increase in total population, from 76,660 in the census base year to 87,165 five years later. Of this increase, 66 percent was estimated as the result of migration and 34 percent the consequence of births over deaths.

Scenario #2: Population Projections

Before proceeding to the development of population projections to a six year capital improvements programming period, it may be appropriate to analyze and critique the methods used by Woodley Blueridge in formulating current year population estimates. This critique should take note of any assumptions that may have been inappropriate or could have been improved upon.

The primary objective of this scenario problem is to develop the basis for population projections for a six-year capital improvements program, reflecting any modifications in assumptions as may be deemed

Table 4-7. Population Estimates (with Migration): City of Rurbania

Age Cohort Base Year	Population Base Year	Five Year Multiplier[a]	Age Cohort Plus 5 Yrs.	Estimated Population	Net Migration[e]	Child Bearing Females	Fertility Rate	Children Under 5
			Under 5	8090				
Under 5	6047	1.17544[b]	5-9	7108	1111			
5-9	6782	1.17494[c]	10-14	7968	1201			
10-14	6706	1.01118	15-19	6781	90	3312	270	894
15-19	7543	1.17157	20-24	8837	1329	3165	270	855
20-24	9689	1.40523	25-29	13615	3986	5448	584	3415
25-29	6398	1.17539	30-34	7520	1167	3718	584	2171
30-34	4608	0.91565	35-39	4219	-349	2122	181	384
35-39	4124	0.955891	40-44	3955	-119	2052	181	371
40-44	4233	1.02562	45-49	4341	188			
45-49	4081	1.01758	50-54	4153	191			
50-54	3564	1.02823	55-59	3665	263			
55-59	3239	1.02164	60-64	3309	288			
60-64	2939	1.02481	65-69	3012	369			
65-69	2400	1.02013[d]	70-74	2448	397			
70-74	1776	0.80000[d]	75-79	1421	18			
75-79	1272	0.70000	80-84	890	5			
80-84	757	0.55000	85-89	415	0			
85-89	371	0.37000	90-94	137	0			
90-94	108	0.17800	95-99	19	0			
95-99	20	0.08600	100 +	2	0			
Over 100	3							
Totals	76660			91905	10135	20217		8090

[a]Equals square root of percent change in cohort.

[b]Equals weighted average of "multipliers" for 15-39 cohorts times 0.5.

[c]Equals weighted average of "multipliers" for 20-44 age cohorts times 0.5.

[d]For cohorts over 70, survival rates applied.

[e]Equals "estimated population" minus "surviving population, plus 5 years" from Table 5.

Table 4-8. Revised Population Estimates: City of Rurbania

Age Cohort Base Year	Population Base Year	Assumed Five Year Multiplier[a]	Age Cohort Plus 5 Yrs.	Estimated Population Plus 5 Yrs.	Net Migration[e]	Child Rearing Females	Fertility Rate	Children Under 5
			Under 5	6539				
Under 5	6047	1.0400[b]	5-9	6289	292			
5-9	6782	1.0400[c]	10-14	7053	286			
10-14	6706	1.0150	15-19	6807	116	3335	216	720
15-19	7543	1.1500	20-24	8675	1167	3123	216	675
20-24	9689	1.3000	25-29	12596	2967	5416	496	2686
25-29	6398	1.1500	30-34	7358	1005	3605	496	1788
30-34	4608	0.9000	35-39	4147	-421	2074	163	338
35-39	4124	0.9500	40-44	3918	-156	2037	163	332
40-44	4233	1.0250	45-49	4339	186			
45-49	4081	1.0150	50-54	4142	180			
50-54	3564	1.0250	55-59	3653	251			
55-59	3239	1.0200	60-64	3304	283			
60-64	2939	1.0250	65-69	3013	370			
65-69	2400	1.0200[d]	70-74	2448	397			
70-74	1776	0.8000	75-79	1421	18			
75-79	1272	0.7000	80-84	890	5			
80-84	757	0.5500	85-89	415	0			
85-89	371	0.3700	90-94	137	0			
90-94	108	0.1780	95-99	19	0			
95-99	20	0.0860	Over 100	2	0			
Over 100	3							
Totals	76660			87165	6946	19590		6539

[a]Multipliers adjusted to reflect generally slower rates of growth in specific cohorts.

[b]Equals weighted average of "multipliers" for 15-39 age cohorts times 0.3.

[c]Equals weighted average of "multipliers" for 20-44 age cohorts times 0.3.

[d]Survival rates applied for cohorts over 70.

[e]Equals "estimated Population" minus "surviving population, plus 5 years" from Table 5.

necessary. By using the approach outlined in the case study, advancing the estimated population by five years is a fairly straightforward process. Formulating a six-year projection, however, will require some ingenuity. Following the completion of this assignment, the projections should be compared and a "consensus estimate" should be developed for application in the fourth scenario.

Instructional Guide #2: Population Projections

Reflecting back to the basic demographic formula,

$$P_2 = P_1 + (\text{Births} - \text{Deaths}) + (\text{Net Migration})$$

$$87,165 = 76,660 + (6,539 - 0) + 6,946$$

$$0 = 2,980$$

it can be determined that Woodley Blueridge's population estimate assumed 2,980 deaths in the five year period, or an average of 596 deaths per year. This level of deaths would result from an average death rate of 7.63 per 1,000, which is considerably lower than the calculated crude death rate of 9.46 per 1,000 for the base year. Similarly, the 6,539 children born during this five year period would result from an assumed annual crude birth rate of 16.89 per 1,000, which again is well below the calculated rate of 21.24 per 1,000 for the base year. Verification of these assumed rates is shown in Table 4-9.

Table 4-9. Assumed Crude Birth and Death Rates

Year	Total Population	Death Rate 7.63/1000	Birth Rate 16.89/1000
0	76,660	585	1,285
1	77,360	590	1,297
2	78,067	596	1,308
4	79,498	607	1,332
5	80,223	607	1,332
Diff.	3,563	2,979	6,542

Therefore, it might be suggested that Blueridge's estimates of current population (base year plus five) tended to underestimate both births and deaths.

While it might be appropriate to assume some reduction in both crude rates, the magnitude of reduction consequent to Blueridge's assumptions seems to be out of line with reasonable expectations. Assuming a ten percent reduction in these crude rates, for example,

would result in a death rate of 8.5 per 1,000 and a birth rate of approximately 19 per 1,000, with the consequences shown in Table 4-10.

Table 4-10. Ten Percent Reduction in Crude Rates

Year	Total Population	Death Rate 8.50/1000	Birth Rate 19.00/1000
0	76,660	652	1,444
1	77,452	658	1,459
2	78,253	665	1,474
3	79,062	672	1,489
4	79,879	679	1,505
5	80,705		
Diff.	4,045	3,326	7,371

These data would suggest that an additional 832 births might have been anticipated in the five year period over the calculations developed by Woodley Blueridge, with some 346 additional deaths occurring. If these adjusted rates are accepted, it is relatively easy to take the additional births into account by merely adding them to the "Under 5" cohort for the current year estimates. The incorporation of the additional deaths is a more complicated matter. The distribution of these additional deaths may be assumed to be a function of the probability of dying for any given cohort times the number of persons in that cohort divided by the total number of persons dying. Such calculations for each cohort will result in a percentage distribution (summing to 100 percent) which can be applied in determining the "spread" of the 346 deaths over the various cohorts. The results of these calculations are shown in Table 4-11; note that the "Under 5" cohort was included in this distribution.

The Revised Population Estimate shown in Table 4-11 represents a 14.3 percent increase in population over the base year. Of this increase, 63.2 percent was estimated as the result of migration and 36.8 percent the consequence of natural increase. The "assumed five year multipliers" shown in Table 4-11 represent the multipliers used by Woodley Blueridge. The "adjusted five year multipliers" can be calculated by dividing the population in an "age cohort plus five years" by the population in the appropriate "base year cohort." These figures represent the actual change in the cohort population as it is moved up five years.

Table 4-11. Revised Population Estimates Reflecting Assumed Crude Birth and Death Rates from Table 4-10

Age Cohort Plus Five Years	Estimated Population Plus Five Years	Assumed Five Year Multipliers	Adjusted Five Year Multipliers
Under 5	7,340	--	--
5 to 9	6,263	1.0400	1.0357
10 to 14	7,024	1.0400	1.0357
15 to 19	6,779	1.0150	1.0109
20 to 24	8,640	1.1500	1.1454
25 to 29	12,545	1.3000	1.2948
30 to 34	7,328	1.1500	1.1454
35 to 39	4,130	0.9000	0.8963
40 to 44	3,902	0.9500	0.9462
45 to 49	4,322	1.0250	1.0210
50 to 54	4,126	1.0150	1.0110
55 to 59	3,639	1.0250	1.0210
60 to 64	3,292	1.0200	1.0164
65 to 69	3,002	1.0250	1.0210
70 to 74	2,440	1.0200	1.0167
75 to 79	1,417	0.8000	0.7979
80 to 84	888	0.7000	0.6981
85 to 89	415	0.5500	0.5482
90 to 94	137	0.3700	0.3693
95 to 99	19	0.1780	0.1759
Over 100	2	0.0860	0.0860
Total	87,650		

Tables 4-12 and 4-13 illustrate the calculations made to arrive at a five-year population projection for the City of Rurbania. The revised estimates in Table 4-11 were "inflated" using the assumed five year multipliers shown in Table 4-12, while the number of children under five were derived through the calculations shown in Table 4-3. Two aspects of this table should be noted: (1) the assumed percentages of females were adjusted to reflect the step-up of cohorts and the trend toward more females in-migrating; and (2) somewhat higher fertility rates were applied in Table 4-13 to compensate, in part for the underestimation of births in Blueridge's calculations.

Finally, Table 4-14 illustrates the process by which the 6th year population distribution can be estimated. One-fifth of each cohort is moved up to the next cohort level and an assumed one-year multiplier is then applied to reflect migration and survival. The under 1 population was computed by assuming a birth rate of 17.60 per 1,000 and applying the following formula:

Table 4-12. 5-Year Population Projection: City of Rurbania

Age Cohort 1975	Population 1975	Assumed Five Year Multiplier	Age Cohort 1980	Projected Population 1980	Net Migration
			Under 5	8,041	--
Under 5	7,340	1.0306[a]	5-9	7,564	285
5-9	6,263	1.0256[b]	10-14	6,423	174
10-14	7,024	1.0110	15-19	7,101	93
15-19	6,779	1.1450	20-24	7,762	1,015
20-24	8,640	1.2500	25-29	10,800	2,213
25-29	12,545	1.1200	30-34	14,050	1,593
30-34	7,328	0.9000	35-39	6,595	- 670
35-39	4,130	0.9500	40-44	3,924	- 156
40-44	3,902	1.0200	45-49	3,980	151
45-49	4,322	1.0100	50-54	4,365	168
50-54	4,126	1.0200	55-59	4,209	270
55-59	3,639	1.0160	60-64	3,697	303
60-64	3,292	1.0100	65-69	3,325	364
65-69	3,002	0.9500	70-74	2,852	287
70-74	2,440	0.8000	75-79	1,952	25
75-79	1,417	0.7000	80-84	992	6
80-84	888	0.5500	85-89	488	-
85-89	415	0.3700	90-94	154	-
90-94	137	0.1760	95-99	24	-
95-99	19	0.1000	Over 100	2	-
Over 100	2	-			
Totals	87,650			98,300	6,121

Table 4-13. Calculation of Children Under 5

Age Cohort 1980	Population 1980	Assumed Percent Female	Number of Females	Fertility Rate	Children Under 5
15-19	7,101	50.0	3,551	245	870
20-24	7,762	45.0	3,493	245	856
25-29	10,800	45.0	4,860	525	2,551
30-34	14,050	40.0	5,620	525	2,950
35-39	6,595	45.0	2,968	165	490
40-44	3,924	50.0	1,962	165	324
Totals	50,232	44.7	22,454	358	8,041

$$\frac{X(1000)}{98428 + X} = 17.6$$

where 98428 equals the population without the addition of the under 1 cohort. The crude birth rate of 17.6 was selected as a further extrapolation of the trend line arising from previous calculations.

Table 4-14. Six-Year Population Projection: City of Rurbania

Age Cohort	5-Year Population Projection	One-Fifth Cohort Population	Adjusted Cohort Population	One-Year Multiplier	6-Year Population Projection
Under 1	1,608	--	--		1,762
1-4	6,433	1,608	6,433	1.0060	6,472
5-9	7,564	1,513	7,659	1.0050	7,697
10-14	6,423	1,285	6,651	1.0022	6,666
15-19	7,101	1,420	6,966	1.0290	7,168
20-24	7,762	1,552	7,630	1.0500	8,012
25-29	10,800	2,160	10,192	1.0240	10,437
30-34	14,050	2,810	13,400	0.9800	13,132
35-39	6,595	1,319	8,086	0.9900	8,005
40-44	3,924	785	4,458	1.0040	4,476
45-49	3,980	796	3,969	1.0020	3,977
50-54	4,365	873	4,288	1.0040	4,305
55-59	4,209	842	4,240	1.0032	4,254
60-64	3,697	739	3,800	1.0020	3,808
65-69	3,325	665	3,399	0.9900	3,365
70-74	2,852	570	2,947	0.9600	2,829
75-79	1,952	390	2,132	0.9400	2,004
80-84	992	198	1,184	0.9100	1,077
85-89	488	98	588	0.8740	514
90-94	154	31	221	0.8352	185
95-99	24	5	50	0.8200	41
Over 100	2	-	7	0.5714	4
Totals	98,300	19,659	98,300		100,190

ENDNOTES

1. Roland Pressat, Demographic Analysis: Methods, Results, Application, translated by Judah Matras (Chicago: Aldine-Atherton, Inc., 1972), pp. 363-364. As Pressat observes, while demographers also attempt to make use of laws governing migration, their work has focused primarily on the study of projections of changes in population consequent to natural increase.

2. The Reed-Merrell Tables used by Blueridge first appeared in The American Journal of Hygiene, Vol. 30, No. 2 (September, 1939).

CHAPTER 5

ESTIMATING LOCAL REVENUES AND EXPENDITURES

Since the end of World War II, expenditures of local governments for various public services have been increasing at phenomenal rates, often outstripping the overall growth of the national economy. In the sixties, for example, annual rates of growth for local expenditures ranged from a high of 12.2 percent for public welfare to a low of 5.0 percent for streets and roads. The combined total for all local public functions has grown regularly at a faster rate than the Gross National Product (GNP); between 1960 and 1971, local government expenditures financed from all sources increased at a compound rate of 9.7 percent per year, while the GNP rose at an annual average rate of only 6.9 percent. These data have even greater impact when it is recognized that a 9.7 percent annual growth rate produced a 177 percent increase in the cost of local government during this period. These differential rates of increase have been further exacerbated during the seventies by the downturn in the economy, coupled with the continued spiralling inflation.

The Elasticity of Local Revenues and Expenditures

The relationship between changes in local government expenditures and the Gross National Product can be examined by a useful measure suggested by James Heilbrun.[1] This index, which Heilbrun calls the "elasticity of local spending," is defined by the following ratio:

$$\text{ELS} = \frac{\text{Percentage Change in Local Government Expenditures}}{\text{Percentage Change in GNP}}$$

When local government expenditures are increasing at a faster rate than the GNP, the value of ELS will be greater than one. Between 1960 and 1971, the ELS for all local governments had a value of 1.406 (i.e., 9.7% divided by 6.9%), whereas during the preceding decade, 1950-60, the value was 1.525 (9.0% divided by 5.9%).

Heilbrun also suggests that it is possible to define the elasticity of local revenue sources in a similar fashion, i.e., by dividing the percentage change in local tax revenues by the percentage change in GNP. If the value of the elasticity of local revenue sources is equal to the value of the elasticity of local spending, and if all expenditures are paid out of local sources, then local government could finance the growth of expenditures year-by-year with no increase in tax rates. The growth of the GNP would induce just enough expansion in the local tax base to provide the revenues needed to pay for growing expenditures.

However, since the end of World War II, the elasticity of local revenues has been far below that of local spending, thus contributing to the persistent financial problems encountered by most local governments.

Property taxes account for about 85 percent of local tax revenues; estimates of its elasticity for the United States as a whole vary from a low of 0.8 to a high of 1.3, with the majority of such estimates placing the value in the range between 0.8 and 1.0. Sales and gross receipts taxes rank second in importance, producing eight percent of local revenue. On a national basis, the general sales tax collected by local governments is estimated to have an elasticity of between 1.0 and 1.27, with the majority of estimates falling at 1.0; in other words, the growth of revenues from the general sales taxes closely parallels the growth of the GNP. Other sources of general revenue (excluding intergovernmental aid), such as taxes on particular commodities and miscellaneous fees and charges, tend to have elasticities well below 1.0.[2] When these parts are added together, it appears that the elasticity for the aggregate of local taxes and charges, at best, is about 1.0 and perhaps somewhat lower. With an expenditure elasticity of about 1.4 and a tax or revenue elasticity of 1.0 or less, it should be clear why local governments are under continual pressure to raise tax rates or to adopt new taxes if they are to finance increases in local expenditures from local revenue sources.

During this period of unprecedented growth in local government expenditures, municipalities and counties have become increasingly dependent upon intergovernmental (state and federal) programs of assistance. As shown in Table 5-1, local property taxes in FY 1949-50 accounted for 50.2 percent of all local general revenues. By 1970-71, while local property taxes increased by 421.5 percent, they accounted for only 39.9 percent of all local general revenues. During this period, intergovernmental transfers increased by 678.5 percent and by 1970-71, accounted for 37.5 percent of all local general revenues.

Efforts of local governments during the past thirty years to develop other tax sources have been successful in only a limited number of larger cities. The near total dependence of local governments on the property tax stems from one inescapable fact -- the lack of viable options. No other form of taxation is readily available for productive use at the local level. Unilateral taxation of income, sales, or business receipts by local governments may prove dysfunctional to the financial well-being of such municipalities. That is, if one municipality in a region introduces such taxes, new economic activities tend to locate beyond its taxing jurisdiction.

Real property, however, is quite immobile. Differential taxes seldom induce migration out of a local geographic area. Workers must reside close to their work; retail outlets tend to locate close to consumers; manufacturing establishments, once committed, tend to stay put, since property taxes are a modest part of their total cost (although such taxes

Table 5-1. Local Governmental Revenues for Selected Fiscal Years

Revenue Category	Fiscal Years					
	1949-50		1959-60		1970-71	
	Millions of Dollars	Percent of Total	Millions of Dollars	Percent of Total	Millions of Dollars	Percent of Total
Total general revenue	$14,014	100.0%	$33,026	100.0%	$91,964	100.0%
Tax revenue	7,984	57.0	18,081	54.8	43,434	47.2
Property tax	7,042	50.2	15,798	47.8	36,726	39.9
Sales & gross receipts taxes	484	3.5	1,339	4.1	3,662	4.0
Income tax	64	0.5	254	0.8	1,747	1.9
Licenses and other taxes	394	2.8	692	2.1	1,289	1.4
Charges & miscellaneous revenues	1,602	11.4	4,831	14.6	14,058	15.3
Intergovernmental transfers	4,428	31.6	10,114	30.6	34,473	37.5
Federal Sources	211	1.5	592	1.8	3,391	3.7
State sources	4,217	30.1	9,522	28.8	31,081	33.8

Sources: U.S. Bureau of the Census, Census of Governments, 1962, and Governmental Finances in 1970-71.

may play an important role in initial location decisions). In short, real property offers a reliable base upon which local governments can safely levy taxes.

The yield from local property taxes in the years following World War II responded fairly well in the aggregate to increases in the Gross National Product, as well as to increases in population. These conditions led Burkhead to conclude in 1963 that: ". . . the property tax is a far better fiscal instrument than most of its critics have allowed. There is every reason to believe that it will continue to hold its relative fiscal importance in state-local public finance structures."[3] Four years later, Benjamin Bridges reached somewhat less optimistic conclusions, reflecting the general inability of local revenue sources to keep pace with the rapid growth of the economy and the parallel increases in public sector costs.[4]

Significant reforms are required in the administration of the property tax. The most serious local administrative fault is inaccurate assessment, in terms of: (a) underassessment, and (b) deviation of individual property values from the general assessment ratio of the taxing jurisdiction.[5] Serious problems also exist with the equity of incidence of local property taxes. Although the property tax is levied, in part, in accordance with the benefit principle, the use of revenues generated by this form of taxation to support many local services that are not based on user-benefit results in a regressive impact with respect to income. Attention to reforms in these areas is required if local governments are to continue to use property taxes as their major source of revenue.

These fiscal discrepancies have an important bearing on the ability and capacity of local governments to finance capital facilites. A community's ability to accumulate capital reserves or to borrow to finance long-term capital investments is conditioned, in large measure, by its overall "financial solvency." Any capital improvements program must be formulated within the financial capacity of government to pay for its needs and desires. A community that cannot meet its short-term public expenditure demands from existing (and projected) sources of revenue will find difficulty in securing willing investors for its long-term bonds. Under such circumstances, investors are likely to demand a high rate of interest to offset the risk. To propose improvements that the government cannot afford, or to propose improvements without a clear notion of how they will be paid for, is to invite unrealistic programs that, from the beginning, are destined to prove unsuccessful.

Current Projection Practices

With few exceptions, the techniques for making revenue and expenditure projections have remained virtually unchanged over the past forty years. Some budget officials simply make "best guesses" about future levels of expenditures and revenues. The common tendency is to allow previous patterns to influence projections; next year's expenditures are determined by applying the observed percentage change in expenditures between this fiscal year and the last fiscal year. Alternatively,

a trend line may be developed by fitting a series of historical data and then extrapolating this trend line to obtain the projection.

The current "state of the art" may be illustrated by a recent publication by the Management Information Service of the International City Management Association.[6] The projection process advocated consists of dividing revenue and expenditures into "readily definable major categories" and then projecting these categories for five to six years on the basis of past trends. These projections are compared to provide some notion of "future free fiscal capacity," that is, the uncommitted monies which can be used for capital expenditures, to establish capital reserves, or for debt service.

While this approach has the advantage of simplicity, it leaves many problems unresolved. Although advocates of this approach stress that such things as the tax base and tax rates may change and that local government officials should be consulted to determine possible deviations from historical trends, allowance seldom is made for any such contingencies in the projections. On the contrary, population often is treated as if it will remain stable regardless of recent rates of growth, and the rate of salary increase of public employees is treated as if it will remain constant.

Even when the goal of local government is to provide the same level of service over a period of years, disruptions in service delivery may result unless likely changes in demand for such services are anticipated with sufficient lead time to make necessary adjustments. Increases in population receiving a particular service may necessitate added personnel and often additional capital equipment and facilities. A new school, for example, should be available when the need exists; a five- to six-year lead time is required to insure the availability of such public facilities at the time the demand becomes critical. Therefore, forecasting is required simply to prevent current services from rapidly becoming inadequate. Furthermore, the uncertainties surrounding federal revenue sharing programs and other forms of intergovernmental assistance give rise to the need for long-range forecasting both to justify requests for such funds and to map out contingency plans if these funds are not forthcoming.

Financial Analysis: Estimating Local Revenues

The fundamental purpose of a financial analysis was stated succinctly some years ago in a report of the National Resources Planning Board.

> . . . (to) determine approximately the present and future ability . . . to pay for the construction and maintenance of public improvements, by estimating the present availability of funds, by research into the probable future trends of municipal revenues and expenditures, by appraisal of all factors related to the administration and operation of the program, and by determining what limitations are imposed, by statutes or prior commitments, upon the freedom of the municipality to act.[7]

The financial analysis which must be undertaken as part of a capital facilities plan is a three-step process which involves:

(1) An estimate of available revenues under existing fiscal policies;

(2) An exploration of alternative fiscal policies; and

(3) The selection of a general fiscal policy which will best fit the future public service and capital expenditure needs in light of the limitations placed on the jurisdiction's financial capacity.

The first step is to determine whether any modifications in existing policies will be required to finance the desired service programs and related capital expenditures. An analysis of available revenues under existing fiscal policies will provide a basis for determining the most advantageous and realistic means by which revenues and expenditures can be brought into equilibrium, i.e., by increasing the former or reducing the latter.

The probable amounts to be received from present rates of taxes and miscellaneous charges must be estimated after thorough analysis of collection trends and conditions affecting the yield from each source. The rates of all service charges (user fees) must be compared to changes anticipated in the cost of rendering the services at the same level and/or increasing the level of service, and consideration must be given to possible adjustments in the rate schedule. In order to accomplish these objectives, it may be desirable to have unit cost data available through cost accounting procedures.

Each source of revenue may require a different formula in order to forecast a reliable budget figure. Each source should be tabulated over a sufficiently long period to establish valid trend lines that take into account both boom and recession periods. It is also necessary to develop and project appropriate indices against which various sources of revenue can be matched in order to make future estimations. Some revenue sources may produce essentially the same yield from year to year, while other revenues fluctuate violently and cannot be relied upon to produce the same amount from one year to the next. Some sources are dependent upon the fiscal policies of other levels of government (e.g., federal aid programs), while other sources are directly or indirectly related to the level of service and capital expenditures provided by government.

For each revenue source, there is a rate or charge and an item subject to levy of tax, license, or charge. The yield must be estimated by determining how frequently the item subject to tax (or charge) will occur. No source of revenue should be estimated solely on collections of the previous year. Some revenue sources are more stable than others; however, a high level of stability should not lull the administrator into the pitfall of routine estimating.

The following procedural steps are suggested as a basis for sound revenue estimates:

(1) A file should be prepared for each source of revenue, containing the following information:

   (a) a summary of the legal background, including date of adoption and reference to ordinances or legislation establishing the charges;

   (b) a summary schedule of rates or charges; and

   (c) a list of factors which influence the revenue yield.

(2) A data sheet on each revenue source should be prepared, showing collection information by months and totals by years.

(3) The percentages collected each month should be compared to annual totals for the past three to five years to indicate seasonal influences and to establish monthly or quarterly revenue estimates for budget control purposes.

(4) Up-to-date information should be maintained indicating local economic conditions and trends; of particular value are data on building construction activity, real estate turnover, retail sales, employment and payrolls, and other common indices of business activities.

(5) The advice should be sought of department heads administering public service for which special charges are made.

(6) Before the budget process is begun for any given fiscal period, preliminary revenue projections should be prepared based on trend factors; these predictions can serve as a guide to the determination of fiscal policy.

(7) Final estimates -- based on trends, economic projections, departmental estimates, and other related factors -- should be prepared immediately prior to the transmission of the budget document to the governing body.

In developing this analysis, all assumptions concerning methodology and current fiscal policies should be carefully recorded. Three basic methods are generally used in forecasting: (1) extrapolation, (2) correlation, and (3) some form of mathematical technique for curve fitting. It is inappropriate, however, to place too much reliance upon statistical formula for computing future trends. Rather, a careful analysis should be made of the various possible factors that may alter past trends or establish new ones.

The second step in the financial analysis is to explore the ramifications of alternative fiscal policies. This should include an analysis of: (1) ways by which the income derived from existing revenue sources might be increased or decreased; (2) the availability and/or feasibility of new

sources of revenue; and (3) the effect of varying borrowing policies on available resources. This analysis must be a continuous process, particularly in light of the ever increasing demands being placed on local governments for services and facilities.

Information on the availability of revenues under existing fiscal policies and analysis of alternative methods of financing must be brought together to focus on recommendations regarding future fiscal policies. This comparison should provide the chief executive and the governing body with the basis for a clear, explicit series of policy statements to guide the programming of capital improvements. The following points are illustrative of the items that should be covered in these statements of fiscal policy.[8]

(1) The total amount of funds to be expended annually for capital improvements in order to achieve and maintain some desirable level of public service.

(2) The ratio to be applied among the various methods of financing capital improvements, i.e., what portion of the required allocation will be available from annual revenues and how much must be financed through borrowing or other methods of financing.

(3) The types and maturities of bonds to be issued for the financing of capital improvements expenditures.

(4) The relationship between self-supporting and tax-supported public improvements and the terms and conditions under which self-liquidating facilities are feasible: all self-supporting projects must clearly demonstrate an ability to produce sufficient revenue to repay their cost (including debt service).

(5) The ceiling on annual debt service charges deemed desirable.

(6) The role of state and federal assistance in the financing of capital improvements.

(7) Fiscal policies with regards to current outstanding debt.

(8) The relationship between the capital and operating budgets.

(9) Policies with regards to new sources of revenues.

(10) The feasibility of maintaining and increasing the borrowing reserve of government.

Every effort should be made to level off and reduce the outstanding debt of government at the earliest possible date. Capital expenditures must be carefully scheduled to ensure a reasonable outstanding debt structure in relation to the general level of the economy, the sources of revenue available, and the overall ability to pay for these improvements. Bond issues should have a limited life period to minimize the debt service charges. Where possible, bond issues should be of the

serial type and should be assumed as general government obligations rather than as specific agency obligations. General obligation bonds normally carry a lower interest rate because they are secured by the "full faith, credit, and taxing power" of local government. In general, maximum maturity periods should not exceed 30 years.

In terms of the ratio among the various methods of financing capital improvements, it may be suggested from experience that at least 20 percent should be financed from current revenues. While this level will vary from area to area and from year to year, as a matter of fiscal policy an effort should be made to establish a clearly defined range within which these adjustments can be made. In accordance with recognized finance principles, annual debt service charges payable from general revenues should not exceed 25 percent of the total funds available.

Case Study #3: Revenue and Expenditures Analysis for Rurbania

Table 5-2 provides a breakdown of governmental revenues for the immediate past fiscal year (ending June 30) in the City of Rurbania. Over the past ten years, governmental revenues in Rurbania have increased by 148 percent, from $12,335,000 to the current level of $30,570,000. This increase reflects both the growth in population that the community has experienced and the rising cost of government which has necessitated increases in general revenues through higher taxes and a greater dependency on intergovernmental sources of funding. Intergovernmental revenues account for 38.0 percent of all general revenues, while 31.9 percent comes from property taxes. Ten years ago, these percentages were 30 and 42 respectively.

The last column in Table 5-2 provides estimates of the annual percentage change in each of these revenue sources over the past ten years. These figures were calculated by Joe Furd, the Assistant City Manager of Rurbania, in order to measure the "elasticity" of local revenue sources, in accordance with methodology developed by James Heilbrun. Using an annual average increase of 7.0 percent for the GNP, Joe Furd determined that, while the "elasticity" of all local revenue sources over the past ten years was 1.17, the index for property taxes (0.944) was less favorable. The relatively high index for "other taxes" (1.5) can be accounted for by the recent adoption of a one percent local add-on to the state sales tax. User charges have increased substantially over the past few years, accounting for a favorable index of 1.46 for sewer and water revenues (although the fee schedule has not been revised recently). The "elasticity of Federal aid to Rurbania has an index of

Table 5-2. Local Governmental Revenues: City of Rurbania

Revenue Category	Past Fiscal Year ($1,000)	Past Fiscal Year Percent of Total	10 Years Previously ($1,000)	10 Years Previously Percent of Total	Annual Average Percent Change
General Revenue (Exc. Interlocal)	$30,570	100.0%	$12,335	100.0%	9.50%
From Local Sources	$18,950	62.0	$ 8,625	69.9	8.19%
Property taxes	9,740	31.9	5,135	41.6	6.61%
Other taxes	5,320	17.4	1,960	15.9	10.50%
Sewer & water fees	2,239	7.3	843	6.8	10.25%
Other charges & fees	1,651	5.4	687	5.6	9.16%
Intergovernmental Revenues	$11,620	38.0	$ 3,710	30.1	12.10%
Federal sources	2,090	6.8	791	6.4	10.20%
State sources	9,530	31.2	2,919	23.7	12.56%
Direct General Expenditures	$30,967		$12,298		9.67%
Percent of Revenues	101.3%		99.7%		

1.457, while the index for state aid is 1.794, thus illustrating the increasing dependency of the city on intergovernmental transfers.

The next step in Joe Furd's analysis of the revenues of Rurbania involved a breakdown of the components that contribute to these revenues. From this study he hoped to build the basis for a better set of revenue projections than those traditionally developed through simple straight line projections of aggregate data.

Table 5-3 provides a breakdown of the true and assessed values of property in the City of Rurbania and illustrates how tax revenues from real property are calculated. Rurbania is heavily dependent upon residential properties for its tax base; nearly 70 percent of the assessed value of property is in residential use. Property in the City of Rurbania is currently assessed at 70 percent of true value, with a property tax rate of $14.00 per $1,000 of assessed value.

Table 5-3. True and Assessed Value of Property in Rurbania

Category of Property	True Value	Assessed Value (70% of True Value)
Residential	$694,267,500	$485,987,250
Commercial	128,657,600	90,060,320
Industrial	125,232,400	87,662,680
Vacant	45,720,500	32,004,350
Totals	$993,878,000	$695,714,600
Property Tax $14.00 per $1,000 of assessed value		$9,740,000

While it might be possible to make more accurate projections of property tax revenues on the basis of this breakdown, Joe Furd recognized that property taxes are a function of the value of real estate, which, in turn, for residential properties reflects the number of dwelling units and the average value per dwelling unit. Joe estimated that for the current fiscal year there are 29,595 dwelling units in the City of Rurbania. These units have an average value of $24,260 for owner-occupied dwellings and $22,500 for renter-occupied units, for a total value of $694,267,500. Table 5.4 provides a further delineation of relevant housing characteristics for Rurbania.

Table 5-4. Housing Characteristics for City of Rurbania

Data Category		Percent of Total
Total Housing Units	29,595	100.0%
Year-round Occupancy	29,595	99.9
Units Owner Occupied	15,170	51.3
Units Renter Occupied	12,830	43.4
Units Vacant	1,595	5.3
Population in Housing Units	82,360	
Median Number of Rooms	5.1	
Median Value		
Owner Occupied	$24,260	
Renter Occupied	$22,500	
Median Price Asked for Vacant Units	$24,130	
Contract Rent (Monthly)	$130	
Tax Rate per $1000 of Assessed Value	$14	
Property Taxes Generated*		
Total	$6,803,369	
Owner Occupied	3,606,637	
Renter Occupied	2,829,015	
Vacant Units	367,717	

*For the purposes of this case study, it is assumed throughout that uncollected and delinquent taxes are negligible.

The state recently has adopted a full assessment policy to be implemented in the coming fiscal year. Under this policy, all properties must be taxed at true market value, with properties being re-assessed every three years (as contrasted to the once-every-five-year assessment policy currently in force).

In developing his revenue projections, Joe Furd assumed that the average value per residential unit would increase by 6 percent, producing a total value of $735,923,550 with no increase in the number of

residential units. He further assumed that there would be a 2.5 percent increase in the number of residential units and that these new units would be constructed at a cost 15 percent over the adjusted median value of residential real estate in the city. These assumptions resulted in the following calculations:

29,595 times .025 = 740 new units

.513($24,260) + .434($22,500) + .053($24,130) = $23,490
1.06
$24,900
1.15
Estimated average value of new units = $28,635

740 times $28,635 = $21,189,900 = total value of new units

Note that Furd assumed the distribution of newly constructed units would be the same as the existing units. There is evidence to suggest, however, that rental units are being built with increasing frequency in Rurbania (70 percent of all building permits issued during the past two years were for apartment construction). Therefore, a further refinement in these calculations would have been to assume a new distribution among the projected units and to carry out the calculations accordingly, as shown below:

($22,500) (1.06) (1.15) (740) (.70) = $14,207,445 (new rental value)
($24,260) (1.06) (1.15) (740) (.30) = $ 6,565,193 (new owner-occupied value)
$20,772,638

By assuming a 70-30 split between renter and owner-occupied units to be constructed, the projected total value of new residential properties is considerably lower ($467,262 difference between two projections). While this discrepancy is not likely to have much impact on the one-year projections that Joe Furd has made, if these trends were to continue over time, the adjustment in distribution should be taken into account.

The next step involved a translation of new and adjusted existing values into generated property taxes. Furd assumed that, with full assessment, the tax rate (millage) would be adjusted downward in order to maintain the same level of effective taxation. In other words, a tax rate of $14 per $1,000 at 70 percent of true value would become $9.80 per $1,000 at 100 percent of true value. Using this tax rate, Furd projected revenues from residential properties for the coming fiscal year to be $7,419,712, a 9 percent increase over the current fiscal year's receipts.

Joe Furd estimated the property taxes to be generated from commercial and industrial uses by formulating a value per acre multiplier (incorporating land values and the values of improvements thereon). As shown in Table 5-5, there are approximately 2,000 acres in commercial development in Rurbania at present, with an average value per acre

Table 5-5. Number and Average Value of Acreage in Commercial, Industrial, and Vacant Land Uses in Rurbania

Use Category	Number of Acres	Average Value per Acre
Commercial	2,000	$64,300
Industrial	1,090	$115,000
Vacant	9,150	$5,000

of $64,300. Joe Furd assumed that with increased development of more extensive commercial facilities (e.g., shopping centers), an additional 150 acres would be developed for commercial purposes in the coming year. As with his estimates for residential property values, he assumed a 6 percent multiplier for existing values and a 15 percent multiplier over the adjusted value for new construction. These asumptions resulted in the following calculations:

$$(2000)(\$64,300)\ (1.06) + (150)\ (\$64,300)\ (1.06)\ (1.15) = \$148,073,250$$

Thus, Furd projected a 15.0 percent increase in the value of commercial land use as a consequence of new construction of more extensive shopping facilities and the general inflationary impacts on existing land values.

Using a similar approach, Furd made projections for industrial land values, as follows:

$$(1090)\ (\$115,000)\ (1.06) + (80)\ (\$115,000)\ (1.06)\ (1.15) = \$144,085,800$$

Here again, Furd assumed a 7.5 percent increase in the acreage devoted to industrial uses, which, with the inflationary factors included, resulted in a 15.1 percent increase in the value of industrial properties.

Furd assumed that vacant land would experience a 10 percent increase in value. He projected that some 370 acres would be removed from the vacant category for residential development, 150 for commercial uses, and 80 for industrial purposes, plus 30 percent of this total for public purposes. Thus, vacant lands will be reduced by approximately 780 acres. The remaining 8,370 acres times the new average value of $5,500 per acre produced a total value of $46,035,000 in Furd's calculations.

Table 5-6 summarizes the calculated values and the property taxes generated by each of these land use categories in accordance with the assumptions made by Joe Furd. These calculations resulted in a projected increase of 10.2 percent in the revenues derived from real property taxes for the coming year in Rurbania.

Table 5-6. Projected True Values and Resulting Property Taxes for Various Land Use Categories

Use Category	Projected True Value	Projected Revenues from Property Taxes
Residential	$757,113,450	$7,419,712
Commercial	$148,073,250	$1,451,118
Industrial	$144,085,800	$1,412,041
Vacant	$ 46,035,000	$ 451,143
Totals	$1,095,307,500	$10,734,014

Joe Furd could have made similar "horseback" estimates for the other sources of revenue. Since most of these miscellaneous sources can be assumed to be a function of population, rough estimates could have been made by using population increases as a basic "multiplier". In all of these estimates, however, assumptions would have to be made regarding the real effects of inflation on the respective values.

Furd chose instead to use his estimate of revenues derived from property taxes as the principal basis for projecting overall revenues. He assumed that property taxes in the coming fiscal year would account for 32 percent of all general revenue available to the City of Rurbania. On this basis, total general revenue was projected to be $33,543,750. From this calculation, he then developed the data shown in Table 5-7.

It should be noted that Joe Furd's estimate for sewer and water revenues reflects the annual average percent change shown in Table 5-2, while his estimates for other tax revenues and receipts from other charges and miscellaneous fees are considerably more conservative than past trends would suggest. Furd reasoned that the annual average percent change index for other taxes was artificially inflated by the recent adoption of a local one percent sales tax add-on, and therefore, the 7.67 percent rate of increase was more realistic. The category of "other charges and miscellaneous fees" is the most difficult to estimate since it incorporates a wide variety of revenue sources. Therefore, Furd felt that a conservative estimate would be most appropriate.

The estimates developed in Table 5-7 reflect an increasing dependence on intergovernmental transfers, with a greater portional share coming from federal sources. The assumptions underlying these estimates appear to be in keeping with national trends and the continuance of federal revenue sharing programs.

Table 5-7. Projected Sources of Revenues: City of Rurbania

Revenue Category	Dollars	Percent of Total	Projected Percent Change
General Revenues (exc. interlocal)	$33,543,750	100.0%	9.73%
From Local Sources	$20,629,500	61.5	8.86%
Property taxes	10,734,000	32.0	10.20%
Other taxes	5,728,000	17.1	7.67%
Sewer & water	2,500,000	7.5	11.66%
Other Charges & Miscell. Fees	1,667,500	5.0	1.00%
Intergovernmental Revenues	$12,914,250	38.5	11.14%
Federal Sources	2,348,000	7.0	12.34%
State Sources	10,566,250	31.5	10.87%

Analysis of Rurbania's Expenditures

Basic categories of budgeted expenditures for both the capital and operating accounts are shown in Table 5-8 for the current fiscal year in the City of Rurbania. It may be noted that the CIP "heuristic" of no more than 25 percent of total expenditures devoted to capital outlays was just exceeded by the sum of all capital expenditures ($7,785,000 or 25.14 percent of total direct expenditures). The largest single category of expenditures for both the operating and capital accounts, as might be expected, was for education; 56 percent of capital expenditures and 50 percent of operating expenditures. Expenditures for sewer and water facilities ($507,000 in capital outlays and $2,816,000 in operating expenses) rank this combined category second, while expenditures for public health care rank third.

The City of Rurbania has $17,750,000 in debt outstanding. Ninety-eight percent or $17,410,000 is in long-term debt, with the major portion ($14,738,000) being for school facilities. As shown in Table 5-9, the city continues to finance a significant portion of its capital facilities on a "pay-as-you-go" basis, with 59 percent of the current capital outlays devoted to this form of financing. The current debt limit, based on four percent of assessed value of all real property, is also shown in Table 5-9. The city currently is utilizing 63.78 percent of its debt capacity.

As with his analysis of revenues, Joe Furd began his study of expenditures by determining the trends in annual average increases in the cost of various public services, as shown in Table 5-10. He found that over the past ten years total expenditures increased at an annual

average rate of 9.8 percent, with the largest annual increases occurring in public welfare, health services, and education. His analysis suggested that those services which are fairly "labor-intensive" are increasing in costs at a rate above the accumulative average, whereas services that are more "capital-intensive" are increasing in costs at a somewhat slower rate. Viewed from another perspective, services which are tied more directly to increases in population (and associated demands) are increasing faster than those which have a relatively high initial fixed cost. The exception to both of these observations, of course, is education, which has a high fixed cost for capital facilities and is fairly labor intensive.

Assuming that these trends would continue and in some cases accelerate, Furd made the projections of operating expenses for the coming fiscal year shown in Table 5-11. Anticipating a major increase in the salaries of law enforcement personnel, Furd multiplied the index for police services by 1.08. Anticipated increases in the cost for health services and fire protection led him to multiply these indices by 1.06. He also made adjustments in education, streets and highways, and public welfare costs by multiplying these indices by 1.04. All other "assumed multipliers" were taken directly from Table 5-10.

As may be seen from Table 5-11, the total operating expenses projected for the coming fiscal year are 10 percent higher than current levels. Comparing this figure of $25,500,000 with the revenue projections in Table 5-7, Furd determined that the anticipated "margin" or "free fiscal capacity" for capital outlays was $8,043,750, which is only 3.32 percent greater than current fiscal year commitments. Since he had previously determined that capital outlays had been increasing at an annual average rate of 9 percent, he calculated that approximately $8,485,650 would be required for the coming fiscal year to meet anticipated capital commitments. In other words, the match-up between anticipated revenues and anticipated expenditures revealed a deficit of approximately $442,000.

Assuming that this deficit had to be made up from local revenue sources (since these are the only sources over which the city government has direct control), Furd recommended that the tax rate be set at $10.00 per $1,000 (rather than the $9.80 per $1,000 initially assumed). He reasoned that with the mandated shift to true market value assessment, this new tax rate would be readily accepted by the citizens of Rurbania. This slightly higher tax rate would produce an anticipated $10,953,075 in revenues, or $219,000 more than in his initial projections.

Secondly, he proposed a 10 percent increase in sewer and water user fees, since his analysis revealed that the revenue produced by these fees was below the actual cost of operating these services. (During the current fiscal year, for example, $2,239,000 were collected in user fees, while $2,816,000 were committed to the operation of these facilities.) This fee schedule adjustment, Furd calculated, would produce an additional $250,000 in revenue for the coming fiscal year. Table 5-12 summarizes the recommended adjustments in projected revenues for the coming fiscal year. As may be seen from these data, a very slight "margin" is projected ($27,100).

Table 5-8. Direct General Expenditures: City of Rurbania

Expenditure Category	($1,000)	Percent of Total
Direct General Expenditures	$30,967	100.00%
Capital Outlay	$ 7,785	25.14
Education	4,362	(56.03)
Streets & Highways	686	(8.81)
Health Care	506	(6.50)
Sewerage Treatment	207	(2.66)
Water Supply	300	(3.85)
Recreation	187	(2.40)
Public Buildings	267	(3.43)
Interest on General Debt	870	(11.18)
Public Safety	400	(5.14)
Operating Expenses	$23,182	74.86
Education	11,588	(50.00)
Streets & Highways	886	(3.82)
Public Welfare	1,422	(6.13)
Public Health	1,500	(6.47)
Police	1,401	(6.04)
Fire Protection	466	(2.01)
Sewer & Water	2,816	(12.15)
Sanitation	520	(2.24)
Parks & Recreation	538	(2.32)
Housing, Renewal, & Planning	250	(1.08)
Corrections	239	(1.03)
Libraries	501	(2.16)
Financial Administration	455	(1.96)
General Administration	375	(1.62)
Public Buildings	225	(0.97)
General Debt Outstanding	$17,750	100.00%
Long-Term Debt	17,410	98.08
Schools	14,738	(84.65)
Sewer & Water	1,288	(7.40)
Recreation	384	(2.21)
Public Buildings	1,000	(5.74)
Short-Term Debt	340	1.92

Table 5-9. Capital Expenditures: City of Rurbania

Expenditure Category	Dollars	Percent of Total
Total Capital Outlays	$7,785,000	100.00%
From General Revenues	$7,388,000	94.90
Principal Payments	2,063,200	(27.93)
Interest Payments	870,000	(11.78)
Payments to Sinking Funds	68,150	(0.92)
Pay-As-You-Go	4,386,650	(59.37)
From Capital Reserves	$ 397,000	5.10%
Current Debt Limit	$27,828,584	
Percent of Debt Limit Committed	63.78%	

Table 5-10. Annual Average Increases In Operating Expenses for Various Public Services: City of Rurbania

Expenditure Category	Compound Annual Rate of Increase Over 10 Years
Total Operating Expenses	9.82%
Education	10.31%
Streets & Highways	5.00%
Public Welfare	12.04%
Public Health	10.82%
Police	9.26%
Fire Protection	7.49%
Sewer & Water	8.24%
Sanitation	6.93%
Parks & Recreation	8.74%
Housing, Renewal, & Planning	9.99%
Corrections	9.63%
Libraries	8.58%
Financial Administration	9.67%
General Administration	9.87%
Public Buildings	6.67%

Table 5-11. Projected Operating Expenditures: City of Rurbania

Expenditure Category	Assumed Multiplier	Dollars ($1,000)
Total Operating Expenses	1.10000	$25,500
Education	1.10725	$12,831
Streets & Highways	1.05190	932
Public Welfare	1.12520	1,600
Public Health	1.11467	1,672
Police	1.10000	1,541
Fire Protection	1.07940	503
Sewer & Water	1.08240	3,048
Sanitation	1.06925	556
Parks & Recreation	1.08735	585
Housing, Renewal, & Planning	1.10000	275
Corrections	1.09625	262
Libraries	1.08580	544
Financial Administration	1.09670	499
General Administration	1.09867	412
Public Buildings	1.06667	240

Table 5-12. Adjusted Projected Sources of Revenue

Revenue Category	Dollars	Percent of Total	Projected Percent Change
General Revenues (exc. interload)	$34,012,750	100.0%	11.26%
From Local Sources	$21,098,500	62.0	11.34%
Property Taxes	10,953,000	32.2	12.45%
Other Taxes	5,728,000	16.8	7.67%
Sewer & Water	2,750,000	8.1	22.82%
Other Charges & Miscell. Fees	1,667,500	4.9	1.00%
Intergovernmental Revenues	$12,914,250	38.0	11.14%
Federal Sources	2,348,000	6.9	12.34%
State Sources	10,566,250	31.1	10.87%
Direct General Expenditures	$33,985,650		
Percent of Revenue	99.9%		

Commentary

This case study has provided an examination of one basic approach to the development of revenue and expenditure estimates that goes beyond the traditional straight-line projections of aggregate data. It might be argued that the technique adopted by Joe Furd is not really all that sophisticated in that it does not involve complicated regression formulas and is dependent upon a number of "horseback" assumptions. However, it does go well beyond traditional methods of estimation in that it permits the analyst to "get into" the disaggregated data to get a feel for the variables that are likely to contribute to the end results. Multiplying the current direct general expenditures by 1.096 (the composite index for the compound annual rate of increase over the past ten years) and current general revenues by 1.09 would have produced a "shortfall" of some $614,000. The factors contributing to this shortfall and the possible sources of its resolution would still be relatively unknown, however.

Scenario #3: Estimating Revenues and Expenditures

The first assignment in this scenario is to prepare a brief analysis and critique of the methods of estimating revenues and expenditures as applied by Joe Furd in the previous case study, noting any assumptions that may be inappropriate or could have been improved upon.

Using the approach adopted by Joe Furd, or any other appropriate method, tables should then be prepared to show estimated revenues and expenditures (by major sources or categories) for the remaining five years of the capital improvements programming period for the City of Rurbania. All assumptions should be clearly stated and sufficient information provided to assess the methodology used. For each fiscal year in the projection period, ar attempt should be made to match-up estimated revenues and expenditures and to resolve any shortfalls (deficits) that might occur. Proposed tax increases or shifts in intergovernmental transfers should be reasonable and politically feasible.

There are no "right answers" to this scenario. Its purpose is to determine the ability of participants to breakdown the financial problems into their component parts, to overcome existing data limitations, and to build a defensible set of estimates.

ENDNOTES

1. James Heilbrun, Urban Economics and Public Policy (New York: St.Martin's Press, 1974), pp. 324-330.

2. Advisory Commission on Intergovernmental Relations, State-Local Finances: Significant Features and Suggested Legislation, 1972 Edition, Report No. M-74, Table 134, p. 301.

3. Jesse Burkhead, State and Local Taxes for Public Education (Syracuse, N.Y.: Syracuse University Press, 1963), p. 70.

4. Benjamin Bridges, Jr., "Past and Future Growth of the Property Tax," in Property Taxation--USA, edited by Richard W. Lindblom (Madison, Wisconsin: University of Wisconsin Press, 1967), pp. 31-37.

5. For a further discussion of these points, see: James A. Maxwell, Financing State and Local Governments (Washington, D.C.: The Brookings Institution, 1969), pp. 137-146.

6. Public Works Committee, Long-Range Programming of Municipal Public Works (Washington, D.C.: National Resources Planning Board, 1941), p. 7.

7. ASPO Planning Advisory Service, "Capital Improvement Programming," Information Report No. 151 (Chicago: American Society of Planning Officials, October, 1961).

CHAPTER 6
METHODS OF FINANCING CAPITAL FACILITIES

As with purchases made by individuals, it is possible for a municipality in financing capital facilities to: (a) pay cash, (b) save money for future acquisitions, or (c) borrow on anticipated earning power. A sound, long-range revenue policy, based on a comprehensive assessment of public service and facility needs, must seek to develop an appropriate mix among these methods of financing.

Pay-As-You-Go

For many years, public officials held that the only appropriate method of financing was to pay for capital facilities (and all other governmental costs) out of current revenues--to "pay-as-you-go." This approach is more economical in the long run, since the cost of borrowed money is eliminated. A second "advantage" often cited is that the planning of improvements and the actual expenditure of public revenues will be handled more efficiently when taxpayers feel the costs more immediately. In the pursuit of efficiency, however, many public officials have foregone the objective of effectiveness, i.e., of providing needed public improvements in a timely manner. Few governments today are able to operate successfully strictly on a pay-as-you go basis.

The feasibility of a complete or partial pay-as-you-go approach (the latter being adopted by many governments) largely depends upon two factors: the nature of the community and the character of the anticipated expenditures. Once the infrastructure of a community has been established, it may be easier to finance required municipal improvements out of increased taxes than is the case in new communities or communities experiencing rapid growth. A pay-as-you-go approach is more feasible when capital expenditures are recurrent, either as to purpose or amount, as for example the paving of streets, acquisition of neighborhood parks, and so forth.

Several procedures may be applied in shifting to a partial or complete pay-as-you-go basis.[1] The term of all new borrowing can be gradually shortened; each new bond issue is given a slightly shorter maturity period than the preceding one. Although at times difficult to maintain, a moratorium on new capital construction may be declared until a substantial portion of the outstanding debt has been retired. A third approach is to require a "down payment" for each new facility from current revenues, gradually increasing the portion of capital outlays to be met from current revenues, and thereby slowly arriving at the desired goal. It is easier, of course, in periods of relative prosperity

to increase taxes or to increase revenues by raising assessed valuations in order to finance capital facilities within the current budget. Alternative sources of current revenues may be adopted to support a pay-as-you-go approach, including nonproperty taxes such as an income or sales tax, nontax revenues such as licenses, fees, and fines, special assessments, service charges such as sewer rentals, and state and federal grant-in-aid programs.

Reserve Funds

Financing capital facilities through the accumulation of a reserve fund (sometimes called a capital reserve) can be thought of as the opposite of borrowing in that the timetable is reversed. A portion of current revenues is set aside each year and usually is invested in order to accumulate sufficient funds to initiate some particular capital project or to finance capital improvements in general. The amount (S) of a reserve fund created by a fixed investment (N) placed annually at compound interest (r) for a term of n years, the first investment being made at the end of the first year, can be expressed by the following formula:

$$S = N \cdot \frac{(1 + r)^n - 1}{r}$$

Thus, an investment of $10,000 a year for ten years at six percent will yield a reserve fund of $131,800. Conversely, the amount (N) that must be placed annually (at the end of the year) at compound interest (r) for a term of n years to create a reserve fund (S) may be calculated by the following formula:

$$N = S \cdot \frac{r}{(1 + r)^n - 1}$$

Should the objective be to develop a reserve fund of $200,000 at the end of ten years, the community would be required to invest $15,173.60 per year at six percent.

Various methods have been devised to insure that reserve funds are used as intended and are not diverted to offset current operating costs. One approach requires that reserve fund allocations be deposited with the state treasurer or other appropriate state finance officer, to be invested and held until time for construction of the local improvement. This approach may be particularly beneficial to smaller units of government, since the state can usually invest the total funds of all depositing municipalities at a higher level of return than could be attained by any one municipality.

A second approach is to create a reserve fund, financed by a regular tax levy or a stipulated amount set aside from the general fund, earmarked

for a specific project approved by a local referendum. Expenditures from the fund are limited to the purpose approved by the electorate, and approval to use the special fund for any other purpose can be obtained only by another local referendum. This approach ties the reserve fund to a specific project (and may result in the creation of a number of reserve funds), the cost of which may be uncertain. Therefore, it may be difficult to project the exact level of "set aside" necessary from annual tax revenues to insure an adequate reserve some years hence.

To provide a greater degree of flexibility, some cities have adopted a basic tax for the financing of public improvements, the revenues from which are assigned to a capital reserve which cannot be used for current operating purposes. Part of the capital reserve can be used to finance improvements on a pay-as-you-go basis for equipment and low-cost construction, such as streets and additions to public buildings; another portion of the fund can be used as down payments for major capital expenditures; and the balance can be used for debt service. Since the rate of the capital improvements tax is set by the overall tax rate of the community, this approach provides an even level of revenue each year.

Borrowing

Government loans are marketed with maturities ranging from a few days to several decades. For purposes of discussion, it is possible to divide government borrowing practices into three categories: (1) short-term loans with maturities of a year or less, (2) intermediate loans with maturities over one year but not more than five years, and (3) long-term loans with maturities of over five years. While this latter category is most commonly associated with long-range financing of capital projects, each may have a role in the financial planning of a municipality.

Short-term government borrowing takes various forms -- bills, certificates, or notes sold to banks or other investors, bank loans, warrants paid out in place of cash, and unpaid bills and claims. Short-term borrowing is most frequently used to smooth out irregularities between expenditure and income flows and to temporarily finance governmental operations during periods when tax receipts fall off unexpectedly.

Intermediate borrowing has limited but definite uses. A city whose outstanding debt is primarily in the form of callable-term bonds (bonds which may be called in and the principal paid in full after a specified period) may discover favorable opportunities to convert a portion of such debt by floating a new intermediate loan at a lower rate of interest. Cities operating largely on a pay-as-you-go basis may resort to loans of intermediate maturities when exceptional expenditures cannot be met from current revenues.

Most state and local governments, at one time or another, find it necessary to issue long-term bonds to finance capital projects. A bond

is the promise of the issuer to pay a specified amount of money (principal) at a specific future date (maturity) and to pay periodically a specified rate of interest. Interest on municipal bonds currently is exempt from all federal income taxes.

Municipal bonds possess three significant features, as follows:

(1) The security of municipal bonds is generally considered to be second only to Federal government bonds.

(2) Municipal bonds have a high marketability, assuring that investors can always sell them if they wish to do so.

(3) The diversity of municipal bonds enables investors to obtain bonds in a geographic area and at a maturity of their preference.

In general, long-term borrowing is appropriate under the following conditions: (1) where the project is of a type that will not require replacement for many years, such as a city hall, auditorium, major health facility, or sewage disposal plant; (2) where the project can be financed by service charges to pay off bond commitments; (3) where needs are urgent for public health and safety purposes or other emergency reasons; (4) where special assessment bonds are the only feasible means of financing improvements in the absence of subdivision regulations or other controls; (5) where intergovernmental revenues may be available on a continuous basis to guarantee the security of the bonds, as in the case of public housing; and (6) for financing projects in newly annexed areas or areas of rapid expansion where the demands on municipal resources are comparatively large and unforeseen.

The proper maturity for a given debt should be determined by the anticipated life of the improvement. Since future generations, as well as the present, will benefit from the improvement, it is deemed appropriate that the payment be spread among all who benefit. Under this approach, however, long-term debt may accumulate until it reaches the legal limit imposed by state legislation. At that point, further public improvements cannot be constructed no matter how pressing the need. Therefore, although the life of an improvement may be properly viewed as setting a maximum maturity for a loan, shorter maturities often are preferable.

Several approaches adopted by some municipalities should be discussed, although they cannot be recommended as sound practices. Debt equalization involves the levelling off of peak-year maturities by refinancing outstanding issues so that, roughly, an equal annual debt service is attained over a period of 15 to 20 years. While representing a "balanced" approach to debt financing, very often little or no room is left in a maturity schedule for the debt service burden of new issues. A gross bonding plan involves a one-time authorization of a large bond issue to cover planned capital improvements over a relatively long time period. The bonds are not issued, however, until needed. This approach

has the advantage of reducing preliminary costs of financing, such as the cost of bond referenda, and assuring the financing of planning programs for the period covered. Gross bonding, however, tends to overemphasize long-term borrowing as the sole means of financing capital improvements. Given the authorization, governmental officials may tend to use up the bonding capacity rather than seek other methods of financing capital projects. A gross bonding plan can be made acceptable if a balanced financing program is adopted in which long-term borrowing forms only a part.

Types of Security

There are four general types of municipal bonds according to the security that stands behind them: (1) General Obligation Bonds, (2) Special Tax or Special Assessment Bonds, (3) Revenue Bonds, and (4) Housing Authority Bonds. As the Advisory Commission on Intergovernmental Relations pointed out in the early sixties:

> By far the most striking change in the composition of local debt during recent years (and which has also involved State Government debt) concerns the type of liability incurred. There is an increased proportion of nonguaranteed bonds, as distinguished from bonds backed by full faith and credit of the issuing government.[2]

Nonguaranteed debt is payable solely from pledged specific sources -- e.g., from earnings of revenue producing activities, from special assessments, or from specific nonproperty taxes.

General Obligation Bonds are secured by a pledge of the full faith, credit, and taxing power of the issuing authority. If bonds are so secured but the taxing power of the issuing authority is limited to a specified maximum tax rate, the bonds are still "general obligation," but they are limited tax bonds and purchasers should be informed of the limitations on the taxing authority of the issuer. For many investors, general obligation bonds are seen as the most "secure" of municipal issues, since the issuing authority has the power to levy taxes at the level necessary to meet debt service requirements. There are, however, practical limits beyond which taxes cannot be successfully collected. Therefore, the security of general obligation bonds, of necessity, is based upon the economic resources of the taxpayers in the issuing governmental unit.[3]

Special Tax or Special Assessment Bonds are payable only from the proceeds derived from a special tax (such as highway bonds payable from a gasoline tax) or from a special assessment levied against those who benefit from the facilities constructed (e.g., special assessments for curbs and gutters in certain residential areas). Special benefit

assessments place a major share of the burden of financing on those individuals or properties receiving the greatest benefit from the improvement. The rising cost of special assessments bonds in recent years has resulted in a large majority being additionally secured by a pledge of full faith and credit, making them general obligation bonds.

Revenue Bonds are payable solely from revenue derived from the operation of the facilities constructed with the proceeds from such bonds. Revenue bonds do not carry the "full faith and credit" pledge; their security is based primarily upon the specific revenue producing activity, special tax, or special fund, rather than upon the economic resources of the taxpayers of the issuing jurisdiction. Municipal bonds payable from a limited or special tax or from specified rents, leases, or appropriations are also classified by some analysts as revenue bonds.

Bonds issued by local public housing authorities and secured by an Annual Contributions Contract obligate the United States Public Housing Administration (PHA) unconditionally to make annual payments that, together with other funds from the local authority available for such purposes (net rental revenues), will be sufficient to cover the principal and interest on bonds when due. Since the annual contribution obligation of the PHA is unconditional, the faith of the federal government, and not the local issuing unit, is pledged to the payment of such bonds.

Nonguaranteed debt was originally developed to finance utility-type operations of local government, such as water supply and sewer treatment facilities. Later, under Federal sponsorship, such debt was broadened to provide for local public housing projects. As recently as 1957, the bulk of all local nonguaranteed debt outstanding had been incurred for these two purposes. Beginning in the late fifties, however, there has been a rapid extension in the use of revenue bonds to finance types of projects traditionally financed by full faith and credit borrowing (e.g., public schools and office buildings), with debt service paid from "rentals" derived from taxes or other general government revenue, from the yield of earmarked nonproperty taxes, or other specific revenue sources.

Method of Redemption

Bonds, according to the method of redemption, fall into two general types: (1) term or sinking fund bonds, and (2) serial bonds. Term bonds become due in a lump sum at the end of the term of the loan (all bonds in the issue mature at the same time) and are met by making annual payments to a sinking fund which, when invested at compound interest, will produce the amount of principal required at the time it comes due. An issue of serial bonds, on the other hand, is retired by annual installments directly from appropriations or from earned income in the case of revenue bonds.

The difficulties in maintaining the integrity of a sinking fund has resulted in the replacement of term bonds by serial bonds in many localities (term bonds are not legal in some states). Sinking fund bonds require expert investment of funds and frequent actuarial computations to determine the adequacy of funds to be applied to the principal payment at maturity. They also lack the flexibility in maturity possessed by serial bonds, which often adds to the marketability of the latter form of issue.

Term bonds do have some advantages, however. The accumulation in the sinking fund may afford a means of disposing of new bond issues when the general market is unsatisfactory, i.e., a municipality may "buy" all or a portion of its own general obligation bonds in a new issue. Sinking funds also afford an opportunity for short-term borrowing when banking accommodations are not readily available, providing proper safeguards are installed to ensure prompt repayment. When long-term bonds are at a premium, it may be possible to market term bonds to the particular advantage of the issuing unit. Finally, used in combination with serial bonds, term bonds may serve to finance utilities and other enterprises that do not have established earning records.

For most cities, particularly smaller communities, and for most purposes, serial bonds are preferable, both because of simpler retirement and greater flexibility in marketing and in arranging the debt structure of the community. With a serial bond issue, some of the bonds mature each year shortly after the date of issue through a maximum period of 10, 20, or 30 years or longer. There are two types of serial bonds: annuity serials and straight serials.

With annuity serials, the annual debt service payment, covering interest and principal during each year that the bonds are outstanding, is approximately the same (like a home mortgage). The portion of the annual payment that covers interest is higher in the early years of the issue but declines as payments toward principal are made. When bonds are issued for the construction of a self-liquidating enterprise, conditions may exist which make the use of serial annuity bonds highly desirable or essential. Thus, in financing projects where earning power will expand gradually or where the facility must have a reserve capacity for future expansion, revenue bonds frequently are issued as annuity serials to avoid a peak level of debt service charges in the early years of operation.

It is possible to calculate the annual debt service on an annuity serial bond by the following formula:

$$\text{Annual Debt Service} = \text{Principal} \times \frac{(r)(1 + r)^n}{(1 + r)^n - 1}$$

Thus the annual debt service for a $1,000,000 annuity serial bond issued at 6 percent with a 10-year maturity would be $135,868.

Straight serial bonds (or declining principal bonds) require annual payments of principal of a predetermined amount. Straight serials are not always redeemed in equal installments, particularly when they are used to finance projects with high start-up costs, although achieving principal payments of approximately equal amounts is a desirable objective. Interest payments are large in early years of the issue and decline gradually as bonds approach maturity.

Straight serials have the general advantage of lowering the total cost of borrowing and of progressively lowering the annual debt service charge, thereby freeing the municipality's margin for new borrowing without increasing the general level of debt service. Thus, for example, a straight serial issue of $1,000,000 at 6 percent interest with a 10 year maturity would have a total debt service (principal and interest) of $1,330,000 (assuming equal principal payments) as compared to $1,358,680 for an annuity serial issued under the same conditions.

While debt service requirements on straight serials are higher in early years, total interest cost is lower because the principal is paid down more rapidly. Provision also can be made for off-setting increasing maintenance costs as the improvement ages, i.e., as the level of debt service declines, a portion of the funds annually allocated in support of the project (or a portion of the revenues derived from the project if it is self-supporting) can be assigned to a reserve fund to cover future maintenance and/or expansion.

There are certain additional modifications to the serial form of debt retirement, including: (a) Deferred Serial Bonds, and (b) Irregular Serial Bonds. With deferred serial bonds, the first annual payment on principal is postponed for several years from the date of issue; this method of financing is only justified for self-liquidating projects and is a very unsound practice in the case of tax-supported debt. Deferred serials may be appropriate in situations where an existing debt is scheduled for rapid retirement and the deferment of the new debt for a few years may provide a better "fit" with the municipality's general retirement schedule.

Irregular serial bonds involve a "balloon maturity", usually in the final year, i.e., a relatively significant portion of the principal is postponed until the full term of the issue is reached. It may be necessary to use such bonds to finance projects for which there is no previous record of earning capacity of where there is some uncertainty as to the amounts that will be available for debt service after operating and maintenance costs are met. Irregular serial bonds almost always carry a provision for early redemption, an action that may take place after reserves have been established. With the proper convenants in the bond ordinance or resolution to prevent the misuse of surplus net income, this method may provide a relatively orderly means of refinancing some of a municipality's debt or for adjusting the overall debt schedule to a more workable program.

Duration of Loans

It is axiomatic that borrowings for public improvements should be retired within the period of the useful life of the facility. The theoretical "useful life" of a facility may be shortened by factors of obsolescence other than actual wear and tear, and as the facility ages, maintenance costs tend to increase significantly. Therefore, the total "life cycle costs" of a facility -- cost of construction, operations, maintenance, and repair -- must be considered in determining the period of usefulness.

In only exceptional cases should a capital project be financed for more than thirty years. Borrowing for a longer period may be justified for more permanent facilities, such as a water system designed with a large future capacity for expansion, whereas projects of a more temporary nature, such as street improvements, call for a relatively short-term form of borrowing (e.g., five to ten years). As a general rule, the debt retirement of a municipality should be scheduled so that at least 25 percent of the outstanding principal is always due for amortization within a five-year period. In this way, if a municipality incurred no new debts, it could liquidate the outstanding principal in a twenty-year period.

Face Amount, Maturity, and Interest Rate

Until recently, practically all municipal bonds were issued with a face amount (or denomination) of $1,000. In recent years, however, bonds in many larger issues have been in $5,000 denominations at the request of the underwriters (agents who purchase bonds from an issuer and distribute them to investors), because many institutions that purchase large amounts of bonds prefer the larger denominations to reduce the number of bonds to be handled.

Several factors must be taken into account in determining the maturity of bond issues. First, there is the usual legal requirement that the bonds be retired within the useful life of the improvement to be financed; some state laws specify the maximum life of an issue in general terms without regard to the purpose. Second, the sooner the bonds are paid off, the lower will be the total interest cost. For example, a twenty-year, five percent serial bond will aggregate interest equal to 52.5 percent of the principal, whereas the same bond issued with a fifteen year maturity would accrue interest equal to only 40 percent of the principal. Third, for tax-supported bond issues, the total debt charges must clearly reflect the municipality's ability to pay. Experience indicates that declining debt charges for combined principal and interest are looked upon more favorably than constant debt charges. Fourth, maturities for any new issue must be planned in such a way that the schedule for all outstanding debts represents a reasonable and economic plan for debt retirement.

The interest rate on term bonds is fixed at the time of the issue and is uniform for all bonds in the issue. The interest rate on serial bonds, however, may vary considerably, as shown in Table 6-1.

Table 6-1. $70 Million San Francisco Bay Area Rapid Transit District General Obligation Bonds, Series G, Issued June, 1967; Due Serially June 15, 1972 to 1999.

Amount	Maturity	Rate	Yield or Price
$ 675,000	1972	6%	3.60%
800,000	1973	6	3.65%
925,000	1974	6	3.70%
1,050,000	1975	6	3.75%
1,200,000	1976	6	3.80%
1,325,000	1977	6	3.85%
1,475,000	1978	6	3.90%
3,400,000	1979-80	6	3.95%
1,925,000	1981	4	3.95%
2,050,000	1982	3.95	100
9,475,000	1983-86	4	100
11,750,000	1987-90	4.05	100
10,200,000	1991-93	4.10	100
11,400,000	1994-96	4.15	100
8,350,000	1997-98	4.20	100
4,000,000	1999	3	4.50%

Source: Newspaper announcement by winning syndicate, as reproduced in Alan Rabinowitz, Municipal Bond Finance and Administration (New York: Wiley-Interscience, 1969).

Initial maturities of the Bay Area Rapid Transit District (BART) issue were relatively small (less than seven percent of the total issue was scheduled for retirement in the first five years) due to the high start-up costs of such a project and the gradual build-up of earning power. These early bonds, however, carry a higher interest rate than bonds with longer maturities so as to make them more attractive to investors seeking relatively short-term commitments.

Yields, Discounts, and Premiums

The "profit" that bondbuyers receive -- the "price" the borrowing government must pay -- is generally expressed on a yield basis, meaning that the selling price is stated as a percentage of the return on the investment that will be

obtained if the bond is held to maturity. Yield takes into account three factors: (a) the "face" rate of interest on the bond, (b) calculated against the bond's selling price, which may involve either a discount or a premium on the face value, (c) with an allowance for annual amortization of the discount or premium. As shown in Table 6-1, bonds with longer maturities generally provide a higher yield (the bonds issued with maturities between 1982 and 1998, as shown in the table, carry a par value price, i.e., the yield on government securities also reflects: (1) the credit standing of the borrowing government, (2) maturity and redemption terms, (3) the trading market which will exist for the issue, and (4) the current level and pattern of interest rates.

Changes in the general money market may result in changes in the investment yield that a bond purchaser may demand. Since the face amount to be paid at maturity and the interest rate are fixed, adjustment in the yield can only be made in the price of the bond. Assume, for example, that a $1,000 bond is issued with a 4.0 percent interest coupon, maturing in ten years. If interest rates in the general money market are rising so that a purchaser can expect to obtain a greater yield on his investment (say, 4.2 percent), the bond will have to be sold at a discount in order to attract buyers (a $1000 bond at 4.0% discounted to $983.80 would yield a 4.20% return in ten years). Conversely, if money rates in the general money market are on the decline, so that 3.7% would be an appropriate investment yield on the bond, a purchaser might be willing to pay a premium for the bond (a $1000 bond purchased at $1024.90, with a coupon rate of 4.0%, held for ten years will yield a 3.7 return on the investment). Since complicated computations are required to determine the dollar price of a bond at a specified yield basis, tables are available that show the dollar price for bonds in the usual range of interest or coupon rates, maturities, and yields.

The credit standing of a government is the investment market's estimate of the probability that the specified interest will be paid in full and the debt will be redeemed in accordance with the specified terms. The higher a government's credit standing, the lower the yield its bonds must carry. A major consideration in the credit standing of a borrowing government is the economic resources of its jurisdiction relative to its outstanding debt. Many investors prefer bonds of a government whose economy is diversified rather than dependent upon a single industry. A wealthy community has greater leeway in imposing debt service taxes, and thus avoiding default; therefore, its bonds carry lower yields than a community whose inhabitants have low average incomes. All other things being equal, a community with a small debt is better able to service it (and therefore has a better credit standing) than one with a large debt. Another consideration affecting a community's credit standing is its prior debt record: if a community has once defaulted, with or without justification, its issues may be stricken from the "approved" lists, and subsequent issues may have to bear much higher yield rates.

The maturity term of a debt issue also affects its yield. The longer the term, the greater is the possibility that intervening events may interfere with eventual redemption (i.e., the greater the uncertainty); hence, the risk is greater, and the expected yield tends to be higher. Moreover, the longer the period to maturity, the greater the chance that better investment opportunities will subsequently appear. On the other hand, institutional investors, such as life insurance companies and pension funds, dislike the trouble, expense, and risk involved in frequent turnover of their investment portfolios, and therefore, may be willing to take a slightly lower yield for a long-term issue.

If there is a continuous trading market in a government's securities after they have been issued, they gain an element of "liquidity", highly valued by many investors who, consequently, may be willing to accept a lower yield. Although the holder is not required to release his bonds until their maturity or call date, he knows that he can sell them at any time. Constant over-the-counter trading of many state and local bonds give them relative liquidity.

Summary

The foundation for sound capital facilities planning must be built upon an appropriate mix of the various methods of financing available to local jurisdictions and a debt policy that reflects the municipality's ability to bear certain levels of debt burden. While relatively few communities are able to finance capital projects strictly on a pay-as-you-go basis, this method of financing, along with the creation of a capital reserve fund, must be used in concert with long-term borrowing. In choosing an appropriate debt form, municipal officials must examine the characteristics of projects to be funded, their earning capacity if self-supporting, the methods of redemption for bonds to be issued, the duration of loans to be secured, and the net interest cost arising from various maturities and interest rates. They also must be cognizant of the general money market and the investment yield sought by potential purchasers. These factors affecting the cost of borrowing are not to be approached lightly, and since most jurisdictions enter the municipal bond market only on an infrequent basis, local officials would be well advised to secure the professional services of a recognized financial consultant as they undertake this important phase of capital facilities planning.

Case Study #4: Capital Improvements Programming Procedures

The growth in population experienced in the City of Rurbania over the past fifteen years has placed considerable demands on the city's educational facilities. In response to these pressures, the Board of Education in the late sixties abandoned the traditional Primary-Secondary school system (i.e., K thru 8 and 9 thru 12) in favor of a three-tiered approach: (1) kindergarten through sixth grade; (2) middle schools (grades 7, 8 and 9); and (3) senior high schools (grades 10, 11 and 12). This shift permitted the accommodation of space needs for the lower grades within the former primary school system but necessitated the construction of two new middle schools: George Washington Middle School and Thomas Jefferson Middle School, both opened in 1971. In the past year, John F. Kennedy High School was opened and the former Rurbania Memorial High School was converted into a middle school. Two new elementary schools have also been opened in the past seven years, bringing to fifteen the number of K thru 6 schools in the city.

Table 6-2. Current School Facilities: City of Rurbania

Grade Level	Schools	Classrooms	Capacity
K thru 6 (Elementary School)	15	300	9,000
7, 8, & 9 (Middle School)	3	140	4,200
10, 11, & 12 (High School)	2	130	3,900

As shown in Table 6-2, there are presently 570 classrooms in the physical plant of Rurbania's public school system. Using a standard of 30 students per classroom, these facilities have the capacity to house 17,100 students. Current school enrollments record 17,426 students, distributed as follows:

K thru 6	9,110
7, 8, & 9	4,232
10, 11, & 12	4,084

Thus, the current facilities are 11 classrooms short of meeting the 30 students per classroom standard. The major deficit (6 classrooms) is at the high school level.

In accordance with a recent directive from the State Board of Education, all public school systems, in order to continue to receive maximum state support, must maintain a standard of no more than 25 students per classroom. In other words, a maximum of 14,250 students can be accommodated in the current classroom inventory of Rurbania if this state standard is to be met. School districts have been given six years to meet this standard.

Stanley Farkel, a senior planner in the Department of Planning and Budget, was given the responsibility for working with the Board of Education in the coordination of the educational facilities component of the six-year capital improvements program. Building upon the population estimates of Woodley Blueridge, the Board of Education prepared the following six-year enrollment projections:

K thru 6	9,250
7, 8, & 9	4,125
10,11, & 12	4,500

In order to meet the State Board of Education standards, 370 classrooms (or an addition of 70 classrooms over the current inventory) would be required at the K thru 6 level. Farkel proposed that of the 70 additional classrooms, 10 be accommodated through mobile classroom units at the various existing elementary schools, as needed, with the remaining 60 classrooms be provided in three new elementary schools to be constructed for occupancy in the late seventies.

At the middle school level, the projected enrollment levels of 4,125 students by 1981-82 would dictate the construction of an additional 25 classrooms. Farkel proposed that these units be added to the existing relatively new middle schools over the next four years as capital funds are available.

Although the projections of high school enrollment (4,500) would require the addition of 50 classrooms over the current inventory, the School Board proposed the construction of a new 65 classroom high school to be available for use by the end of the six year programming period. The School Board argued that this size facility would be required to maintain a balance in the high school system of Rurbania.

Current costs for various classroom facilities are shown in Table 6-3. It is estimated that these costs will increase at a rate of 8 percent per year over the next ten years. In other words, a new elementary school classroom two years from now would cost $(1.08)^2$ times $62,600 or approximately $73,000. Cost calculations include all supporting facilities appropriate to a given type of classroom

(additional vs. new facility) such as halls, general purpose rooms, officies, athletic facilities, lavatories, etc. Figures for new schools also include an estimate of basic site development costs. Land acquisition costs, however, must be funded separately.

Table 6-3. Cost Estimates for Various Classroom Facilities

Type	Cost	Capacity
Elementary (new school)	$62,600	25
Elementary (addition)	$45,400	25
Middle School (new school)	$69,000	25
Middle School (addition)	$48,600	25
High School (new school)	$73,400	25
High School (addition)	$51,800	25

Farkel next calculated estimated costs for various years for the recommended facilities, as shown in Table 6-4. Before decisions could be made regarding the timing and method of financing these new facilities, however, it was necessary for Farkel to determine the debt margin and the debt service limits that might prevail during the programming period.

Table 6-4. Estimated Costs for Recommended Educational Facilities

Facility	Capital Improvement Program			
	1	2	3	4
20 classroom Elementary School	$1,352,000	$1,460,300	$1,577,200	$1,703,400
25 additional classrooms--middle school	$1,312,200	$1,417,200	$1,530,600	$1,653,000
65 classroom High School	$5,152,700	$5,564,900	$6,010,000	$6,490,900

As shown in Table 6-5, Rurbania in its current capital budget had $13,339,325 in total principal outstanding for educational facilities. An educational debt limit of $16,000,000 was established by the City Council to provide a benchmark against which to compare actual commitments. This figure for the current budget year is increased by

approximately eight percent per year during the programming period. As may be seen from the data in Table 6-5, the city has a fairly substantial debt margin for educational facilities.

A second constraint is that of debt service limit. This heuristic reflects the anticipated time required to retire a given level of debt as well as the interest commitments associated with such debt. As a rule of thumb, it should be possible to retire outstanding debt in fifteen years and to meet interest charges equal to at least five percent of current principal outstanding. As shown in Table 6-5, this rule of thumb translates into 11.67 percent of the current debt limit, or $1,866,667.

These constraints are not legally binding in terms of state enabling legislation pertaining to municipal capital improvements programming. They do reflect, however, sound principles of public finance and have been adopted by the City Council to guide decisions regarding capital commitments.

The first constraint represents a proration of the city's overall debt limit (which is, of course, a limitation established by state enabling legislation). The underlying rationale for this limit on indebtedness for educational facilities stems from the desire on the part of City Council to maintain long-term debt commitments for schools at no more than fifty percent of the total debt limit for the municipality. In the past fiscal year, educational facilities accounted for approximately 53 percent of the total debt limit (established at four percent of assessed value of all real property within Rurbania). Under newly mandated practices of full value assessment, the debt limit of Rurbania will be established at three percent, and the debt limit for the current fiscal year is $32,000,000. Limiting the level of indebtedness for educational facilities to fifty percent of this figure resulted in the $16,000,000 debt limit shown in Table 6-5.

The second constraint on debt service is a modification of a recognized CIP heuristic that suggests the funds required to retire five percent of the outstanding principal on all bonds plus cover the total annual interest requirements should not exceed 25 percent of a normal budget. This guideline is based on the notion that a municipality should be able to retire its indebtedness within 20 years (or five percent per year). Since Rurbania has elected to issue bonds for shorter time periods (10 to 15 years), the heuristic was appropriately modified to reflect the need to liquidate the city's indebtedness within fifteen years.

Examining the data in Table 6-5, Farkel determined that, while the overall debt limit on educational facilities would not constitute a binding constraint on further borrowing, the second guideline regarding the limitation on annual debt service was not, in fact, being met in the current capital budget and would not be in conformance until the second year of the capital improvements program (i.e., three years hence).

Table 6-5. Summary of Outstanding Current Debt Obligations for Educational Facilities

Category	Capital Budget	Capital Improvements Programming Period				
		1	2	3	4	5
Total Principal Outstanding	$13,339,325	$12,002,657	$10,626,013	$ 9,714,699	$ 8,251,860	$ 7,087,953
Principal Payments	$ 1,386,609	$ 1,426,585	$ 1,468,506	$ 1,512,780	$ 1,213,848	$ 1,261,393
Interest Payments	$ 675,508	$ 609,632	$ 546,460	$ 478,387	$ 424,669	$ 365,624
Total Debt Service	$ 2,062,117	$ 2,036,217	$ 2,014,966	$ 1,991,167	$ 1,638,517	$ 1,627,017
Sinking Fund	$ 530,513	$ 603,672	$ 679,758	$ 758,887	$ 841,181	$ 928,766
Educational Debt Limit	$16,000,000	$17,280,000	$18,662,400	$20,155,400	$21,767,800	$23,509,225
Debt Margin*	$ 3,191,188	$ 5,881,015	$ 8,716,145	$11,199,588	$14,357,121	$17,350,038
Debt Service Limit**	$ 1,866,667	$ 2,016,000	$ 2,177,280	$ 2,351,463	$ 2,539,577	$ 2,742,743

*Equals Debt Limit minus Total Principal Outstanding plus Sinking Fund

**Equals 1/15 of Debt Limit plus 5% of Debt Limit (or 11.67% of Debt Limit)

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The debt service of $2,062,117 required to support the commitments in the current capital budget is nearly 10.5 percent in excess of the debt service heuristic.

In view of this situation and mindful of the City Council's strong desire to adhere to these guidelines, Farkel recommended that additional borrowing be deferred for three years, at which time $1,460,300 be issued as a straight series bond with a 20 year maturity to finance the construction of Woodrow Wilson Elementary School. Using the interest rates on various types of school bond issues shown in Table 6-6, Farkel calculated that this new issue, carrying an assumed coupon rate of 5.50 percent, would add $153,332 to the debt service charges for that fiscal year, which, when added to the continuing commitment of $2,014,966 shown in Table 6-5, would be within the $2,177,280 projected limit.

Table 6-6. Interest Rates on Various Types of School Bond Issues

Type	Maturity	Interest Rate
Straight Serial	10	6.00%
Straight Serial	15	5.75%
Straight Serial	20	5.50%
Term Bond	10	5.50%
Term Bond	15	5.25%
Term Bond	20	5.00%
Annuity Serial	10	5.85%
Annuity Serial	15	5.60%
Annuity Serial	20	5.35%
Deferred Principal (Five Years)	15	5.50%
Deferred Principal (Five Years)	20	5.00%

As shown in Table 6-7, other bond options, such as the straight serial with 15 year maturity and the annuity serial with 15 year maturity, would have a lower total debt service cost over the life of the issue.

Farkel rejected these alternatives, however, in favor of the 20-year straight serial bond for the following reasons: (1) the 15-year straight serial issue, while having the lowest total debt service cost among the alternatives in Table 6-7, would require debt service payments in the target year higher than allowed by the debt service heuristic; and (2) both the annuity serial and the term bond with 15 year maturity would commit the city to a fixed level of debt service that would inhibit future flexibility in accepting additional commitments. The 20-year straight serial bond issue, on the other hand, has a declining annual debt service charge.

Assuming this additional debt service commitment for the target year, the total debt service would be $2,140,482, leaving a "margin" of $210,981. Farkel proposed that this "margin" be used to finance the debt service on a $2,106,160 annuity bond issue with a 15 year maturity (5.60 percent interest). These funds would be used to construct the Harry S. Truman Elementary School (at a cost of $1,577,200) and to add eight classrooms to the middle school system (at a cost of $528,960). The initial debt service on this bond issue would be $210,224, or just within the projected "margin."

Table 6-7. Debt Service Costs for Various Types of Bond Issues to Finance the Construction of Woodrow Wilson Elementary School ($1,460,300)

Type	Total Debt Service	First Year Debt Service
Straight Serial with 15 year maturity @ 5.75% interest	$2,132,038	$181,320.58
Annuity Serial with 15 year maturity @ 5.60% interest	$2,196,744	$146,451.58
Term Bond with 15 year maturity @ 5.25% interest (4.0% sinking fund)	$2,243,921	$149,594.75
Straight Serial with 20 year maturity @ 5.50% interest	$2,303,623	$153,332.00
Deferred Principal Bond with 20 year maturity @ 5.00% interest	$2,409,495	$ 73,015.00
Annuity Serial with 20 year maturity @ 5.35% interest	$2,413,613	$120,680.65

With these additional commitments, the total debt service charges for the fourth year of the capital improvements program are projected to be $1,995,041. As shown in Table 6-5, the estimated debt service limit

for that year is $2,539,577, providing a debt service "margin" of $544,536. Farkel proposed to use $466,676 of this "margin" to finance the debt service charges on a 10 year straight serial bond issue of $2,917,350 to finance the construction of James Madison Elementary School ($1,703,400) and the addition of 17 classrooms to the middle school system ($1,213,950).

The construction of a new 65 classroom high school, the final recommended addition to the current facility inventory, presented a greater problem. Deferring this project to the fifth year of the capital improvments program would result in an estimated construction cost of $6,500,000. The debt service heuristic, however, would not permit any earlier financing through borrowing. Therefore, Farkel recommended the establishment of a capital reserve fund, to be paid out of annual revenues, to accumulate $2.5 million over the next five years (beginning with the current capital budget). This fund would require annual payments of $456,980 compounded at 4.5 percent interest. The remaining $4.0 million he proposed be financed through a 25 year straight serial bond, carrying a 4.5 percent coupon rate.

All of the existing and proposed capital commitments for the next six years are summarized in Table 6-8. The first page of this table lists the current commitments and should sum to the data shown in Table 6-5 for each year of the capital improvements program. The second page outlines the new commitments, including the funding from general revenues of the land acquisition program for the proposed new construction. Page three identifies the additional items to be financed from general revenues (pay-as-you-go financing), including the temporary classroom facilities, and up-dates the data shown previously in Table 6-5. It should be noted that a decision was made to acquire 20 temporary classrooms (at $30,000 each) to provide more immediate relief to current overcrowded conditions in the elementary and high schools. Ten of these units will be financed out of the current capital budget, with five more being acquired in each of the next two years.

Commentary

The approach that Stan Farkel adopted in this case study illustrates a set of procedures appropriate to the development of a capital improvements program. Initial needs were identified by the agency having functional responsibilities for carrying out the programs associated with these capital facilities and were based on both established standards and projections of client population. These needs were then translated into facility costs for various time periods. The adoption of a set of heuristics to establish the operational parameters within which various alternative solutions could be explored served as the next step in the process. The choice among the options available reflected both the basic guidelines limiting total commitments and the need to maintain flexibility for assuming additional commitments in the future. Although the recommendations proposed by Stan Farkel did not necessarily represent an optimal strategy for financing these projects, they did afford the flexibility required to incorporate all of the identified needs on a priority

basis with the minimum violation of the basic heuristics. It should be noted from page 3 of Table 6-8 that the total debt service in final year of the CIP is slightly in excess of the projected debt service limit. This amount ($25,960), however, is not particularly critical given the assumptions underlying the projected debt service limit and the time frame of these commitments.

Scenario #4: Capital Improvements Programming Procedures

The basic objective of this scenario assignment is to evaluate and up-date the analysis developed by Stanley Farkel in the previous case study. Building on the population projections developed out of the estimates of Woodley Blueridge in scenario #2, the first task should be to assess the viability of the six-year enrollment estimates made by the Rurbania School Board. Is the number and distribution of classroom needs discussed in the case study appropriate in light of these projections? How many classrooms at the various levels of the three-tiered system will be required to meet the standard of 25 students per classroom?

Having completed the re-assessment of classroom needs, the next step should be to convert these facility needs into a funding strategy, including a determination of the timing, cost, and appropriate methods of financing for new capital construction. The data in Table 6-3 may be used in determining classroom costs, up-dated as appropriate to reflect the effects of inflation (i.e., 8 percent per year). In selecting appropriate interests rates from Table 6-6, the two basic heuristics adopted by the Rurbania City Council should be maintained.

The basic product of this scenario should be an up-dated version of pages 2 and 3 of Table 6-8 from the case study to include an enumeration of new facilities to be financed during the capital improvements programming period and a summary of the obligations for educational facilities.

Table 6-8. Current and Projected Obligations for Educational Facilities: City of Rurbania

Facility	Method of Financing	Capital Budget	Capital Improvements Program				
			1	2	3	4	5
George Washington Middle School	$3,200,000 straight serial bond/ 10 yrs. @ 4.50% with 1980 maturity	$1,280,000 320,000 57,600	$ 960,000 320,000 43,200	$ 640,000 320,000 28,800	$ 320,000 320,000 14,400	retired	retired
Expansion of Administration Bldg.	$682,000 annuity serial bond/ 10 yrs. @ 5.00% with 1982 maturity	$ 448,296 65,907 22,415	$ 382,389 69,203 19,119	$ 313,186 72,663 15,659	$ 240,523 76,296 12,026	$ 164,227 80,111 8,211	$ 84,116 84,116 4,206
John F. Kennedy High School	$5,000,000 annuity serial bond/ 10 yrs. @ 5.00% with 1984 maturity	$3,746,809 460,183 187,340	$3,286,626 483,192 164,331	$2,803,434 507,251 140,171	$2,803,434 532,719 114,804	$2,270,715 533,987 113,536	$1,736,728 560,687 86,836
Theodore Roosevelt High School --Addition	$2,025,000 straight serial bond/ 15 yrs. @ 5.00% with 1985 maturity	$1,215,000 135,000 60,750	$1,080,000 135,000 54,000	$ 945,000 135,000 47,250	$ 810,000 135,000 47,250	$ 675,000 135,000 33,750	$ 540,000 135,000 27,000
Thomas Jefferson Middle School	$2,500,000 annuity serial bond/ 15 yrs. @ 5.25% with 1985 maturity	$1,721,790 154,549 90,394	$1,567,241 162,663 82,280	$1,404,578 171,203 73,740	$1,233,375 180,191 64,752	$1,053,184 189,651 55,292	$ 863,533 199,608 45,335
Patrick Henry Elementary School	$2,000,000 straight serial bond/ 20 yrs. @ 4.75% with 1988 maturity	$1,200,000 100,000 57,000	$1,100,000 100,000 52,250	$1,000,000 100,000 52,250	$ 900,000 100,000 42,750	$ 800,000 100,000 38,000	$ 700,000 100,000 33,250
Abraham Lincoln Elementary School	$3,000,000 annuity serial bond/ 20 yrs. @ 5.50% with 1993 maturity	$2,727,430 101,029 150,009	$2,626,401 106,586 144,452	$2,519,815 112,448 138,590	$2,407,367 118,633 132,405	$2,288,734 125,158 125,880	$2,163,576 132,041 118,997
Athletic Fields	$1,000,000 term bonds/ 15 yrs. @5.00% with 4.00% sinking fund, 1983 maturity	$1,000,000 49,941 50,000	$1,000,000 49,941 50,000	$1,000,000 49,941 50,000	$1,000,000 49,941 50,000	$1,000,000 49,941 50,000	$1,000,000 49,941 50,000

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Table 6-8. Continued (page 2 of 3 pages)

Facility	Method Financing	Capital Budget	Capital Improvements Program				
			1	2	3	4	5
Woodrow Wilson Elementary School	$1,460,300 straight serial bond/ 20 yrs. @ 5.50% with 1998 maturity			$1,460,300 73,015 80,317	$1,387,285 73,015 76,300	$1,314,270 73,015 72,285	$1,241,255 73,015 68,269
Harry S. Truman Elementary School	$1,577,200 annuity serial bond/ 15 yrs. @ 5.60% with 1993 maturity				$1,577,200 68,852 88,323	$1,508,348 73,707 84,468	$1,434,641 77,835 80,340
Middle School Addition 8 Rooms	$528,960 annuity serial bond/ 15 yrs. @ 5.60% with 1993 maturity				$ 528,960 23,427 29,622	$ 505,533 24,739 28,310	$ 480,794 26,125 26,924
James Madison Elementary School	$1,703,400 straight serial bond/ 10 yrs. @ 6.00% with 1990 maturity					$1,703,400 170,340 102,204	$1,533,060 170,340 91,984
Middle School Addition 17 Rooms	$1,213,950 straight serial bond/ 10 yrs. @ 6.00% with 1990 maturity					$1,213,950 121,295 72,837	$1,092,655 121,295 65,559
Rurbania Memorial High School	$4,000,000 straight serial bond/ 25 yrs. @ 4.50% with 2006 maturity						$4,000,000 160,000 180,000
Capital Reserve Fund for New High School	General Revenues ($456,980 @ 4.5% over 5 years = $2,500,000)	$ 456,980	$ 456,980	$ 456,980	$ 456,980	$ 456,980	
Land Acquisition	General Revenues	$ 300,000	$ 550,000	$ 650,000	$ 300,000	$ 300,000	
Capital Equipment Replacement	General Revenues	$ 700,000	$ 756,000	$ 816,500	$ 881,800	$ 952,300	$1,028,500

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Table 6-8. Continued (page 3 of 3 pages)

Facility	Method of Financing	Capital Budget	Capital Improvements Program				
			1	2	3	4	5
New Capital Equipment	General Revenues	$ 600,000	$ 756,000	$ 924,500	$1,106,400	$1,303,000	$1,515,200
Temporary Classroom Facilities	General Revenues	$ 300,000	$ 150,000	$ 150,000			
Summary of Obligations for Educational Facilities							
Total Principal Outstanding		13,339,325	12,002,657	12,086,313	13,208,144	14,497,361	16,870,358
Principal Payments		1,386,609	1,426,585	1,541,521	1,678,074	1,676,944	1,890,003
Interest Payments		675,508	609,632	626,777	672,632	784,773	878,700
Total Oebt Service		2,062,117	2,036,217	2,168,298	2,350,706	2,461,717	2,768,703
Pay-As-You-Go Financing		2,356,980	2,668,980	2,997,980	2,745,180	3,012,280	2,543,700
Total Capital Outlay		4,419,097	4,705,197	5,166,278	5,095,886	5,473,997	5,312,403
Sinking Fund		530,513	603,672	679,758	758,887	841,181	928,766
Capital Reserve		477,544	976,578	1,498,068	2,043,024	2,500,000	
Educational Oebt Limit		16,000,000	17,280,000	18,662,400	20,155,400	21,767,800	23,509,225
Oebt Margin		3,191,188	5,881,015	7,255,845	7,706,143	8,111,620	7,567,633
Oebt Service Limit		1,866,667	2,016,000	2,177,280	2,351,463	2,539,577	2,742,743

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Instructional Guide #4: CIP Procedures

As shown in Table 6-9, the population projections developed in scenario #2 would suggest that the six-year enrollment estimates made by the Rurbania School Board significantly underestimated classroom needs at the elementary school level (K through 6). While the School Board estimates translated into a need for 60 additional classrooms, the revised projections in scenario #2 indicate a need for 115 additional

Table 6-9. Enrollment Projections and Classroom Needs Based on Revised Population Projections for Rurbania

Grade Level	Age Cohort	Population	Enrollment	Classrooms		
				Needed	Available	Deficit
K-4	5-9	7,697				
5	10	1,333	10,363	415	300	115
6	11	1,333				
7	12	1,333				
8	13	1,333	4,000	160	140	20
9	14	1,333				
10	15	1,433				
11	16	1,434	4,660	187	130	57
12	17	1,433				
	18	360*				
Totals			19,023	762	570	192

*25 percent of projected population in age cohort.

classrooms at the elementary school level. Middle schools projections are more in accord, with 25 additional classrooms assumed under the School Board's estimates and 20 under the revised projections. It would appear from the revised projections that the construction of a 65 classroom high schools would represent an overbuilding, as future high schools enrollments are likely to remain steady or decline slightly. Therefore, a 57 classroom facility is proposed, with capacity for future expansion.

On the assumption that commitments have already been made for the construction of the Woodrow Wilson Elementary School as a 20 classroom facility, it might be proposed that the additional classroom needs be met as follows:

(1) The proposed Harry S. Truman and James Madison Elementary Schools each be expanded from 20 to 25 classrooms.

(2) A fourth new elementary school (Samuel Adams) be scheduled for the fourth year of the CIP with a 25 classroom capacity.

(3) Twenty classrooms be added to existing elementary schools to be financed out of general revenues in the fifth year of the CIP.

These additions to existing and proposed commitments will yield 55 classrooms beyond the level scheduled in the proposals of Stanley Farkel.

In order to free-up the debt service capacity to assume these additional commitments, it might be suggested that the twenty classrooms required to meet the deficit at the middle school level be financed from general revenues (in the third and fourth years of the CIP) rather than through the issuance of 15-year annuity serial bonds and 10-year straight serial bonds. It also will be necessary to allocate additional funds from general revenues for the acquisition of land for the proposed Samuel Adams Elementary School. An additional $410,000 has been set aside for this purpose in the revisions to Table 6-8.

The proposed strategy to fund the construction cost for the new Rurbania Memorial High School through the development of a capital reserve fund in combination with a major bond issue scheduled for the fifth year of the CIP can be maintained under these revised procedures. Under the approach outlined in the revisions to Table 6-8, however, the surplus from general revenues available under the heuristics adopted by the City Council is earmarked for the capital reserve fund, thus further reducing the level of borrowing necessary. Consequently, it is possible to finance the proposed 57 classroom facility through the capital reserve fund and a 20-year annuity serial bond issue (as contrasted to the 25-year straight serial bond issue required under Farkel's proposed CIP).

The proposed capital improvements programming strategies are fully detailed in Table 6-8 (Revised). The four new elementary schools are scheduled for the second, third, and fourth years of the CIP, with the 20 classrooms to be added to existing facilities in the fifth year. Additions to the middle schools are scheduled for the third (9 classrooms) and fourth (11 classrooms) years of the CIP, funded on a pay-as-you-go basis. The capital reserve fund for the new high schools is established in the current capital budget, with contributions made over the five years of the capital improvements program. The 20-year annuity serial bonds are scheduled to be issued in the fifth year of the CIP. Funding for new capital equipment and capital equipment replacement, as well as for land acquisition (all to be paid out of general revenues) is also shown in Table 6-8 (Revised). Under this approach, only 15 temporary classrooms are proposed.

Table 6-10 provides a summary of proposed capital outlay obligations for educational facilities during the six-year programming period. It should be noted that the CIP heuristic adopted by the City Council (no more than 12.5 percent of Direct General Expenditures devoted to capital outlay for education) is maintained from the second year of the CIP onward, i.e., during the period in which new construction is proposed. The debt service limits are also met during these four years of the CIP.

The total cost to Rurbania (including total debt service over the life of the bond issues) for these educational facilities is shown in Table 6-11. The comparison illustrates that, while the revised strategy will cost Rurbania approximately $4,250,000 more than the approach pro-

Table 6-8 (Revised). New Capital Construction Commitments (page 2 of 3 pages)

Facility	Method of Financing	Capital Budget	Capital Improvements Program				
			1	2	3	4	5
Woodrow Wilson Elementary School (20)	$1,460,300 annuity serial bond/ 15 yrs. @ 5.60% with 1992 maturity			$1,460,300 64,675 81,777	$1,395,625 68,297 78,155	$1,327,328 72,122 74,330	$1,255,206 76,160 70,292
Harry S. Truman Elementary School (25)	$1,917,450 annuity serial bond/ 15 yrs. @ 5.60% with 1993 maturity				$1,971,450 87,313 110,401	$1,884,137 92,202 105,512	$1,791,935 97,366 100,348
Samuel Adams Elementary School (25)	$2,129,165 annuity serial bond/ 15 yrs. @ 5.60% with 1994 maturity					$2,129,165 94,298 119,233	$2,034,867 99,578 113,953
James Madison Elementary School (25)	$2,129,165 straight serial bond/ 15 yrs. @ 5.75% with 1994 maturity					$2,129,165 141,944 122,427	$1,987,221 141,944 114,265
Rurbania Memorial High School (57 Rooms)	$3,481,496 annuity serial bond/ 20 yrs. @ 5.35% with 2000 maturity ($2,665,878 from Capital Reserve)						$3,481,496 101,454 186,260
Additions to Middle Schools (9 Rooms)	General Revenues				$ 550,998		
Additions to Middle Schools (11 Rooms)	General Revenues					$ 727,317	
Additions to Elementary Schools (20 Rooms)	General Revenues						$1,334,160

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Table 6-8 (Revised). Continued (page 3 of 3 pages)

Facility	Method of Financing	Capital Budget	Capital Improvements Program				
			1	2	3	4	5
Land Acquisition	General Revenues	$ 300,000	$ 550,000	$ 790,000	$ 335,000	$ 300,000	$ 235,000
Capital Reserve Fund for New High School	General Revenues (@ 4.50%)	$ 456,980	$ 456,980	$ 459,717	$ 457,817	$ 490,881	$ 13,908
Capital Equipment Replacement	General Revenues	$ 700,000	$ 756,000	$ 816,500	$ 881,800	$ 952,300	$1,028,500
New Capital Equipment	General Revenues	$ 600,000	$ 756,000	$ 924,500	$1,106,400	$1,303,000	$1,515,200
Temporary Classrooms (15)	General Revenues	$ 300,000	$ 150,000				

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Table 6-10. Summary of Obligations for Educational Facilities

	Capital Budget	Capital Improvements Program				
		1	2	3	4	5
Total Principal Outstanding	$13,339,325	$12,002,657	$12,086,313	$13,081,774	$15,721,655	$17,638,678
Principal Payments	$ 1,286,609	$ 1,426,585	$ 1,533,181	$ 1,668,390	$ 1,614,414	$ 1,777,895
Interest Payments	$ 675,508	$ 609,632	$ 628,237	$ 666,943	$ 846,171	$ 950,742
Total Debt Service	$ 1,962,117	$ 2,036,217	$ 2,161,418	$ 2,335,333	$ 2,460,585	$ 2,728,637
Financing from General Revenues	$ 2,356,980	$ 2,668,980	$ 2,990,717	$ 3,332,015	$ 3,773,498	$ 4,126,768
Total Capital Outlay	$ 4,319,097	$ 4,705,197	$ 5,152,135	$ 5,667,348	$ 6,234,083	$ 6,855,405
Sinking Fund	$ 530,513	$ 603,672	$ 679,758	$ 758,887	$ 841,181	$ 928,766
Capital Reserve	$ 477,544	$ 976,578	$ 1,500,928	$ 2,046,889	$ 2,651,970	$ 2,665,878
Educational Debt Limit	$16,000,000	$17,280,000	$18,662,400	$20,155,400	$21,767,800	$23,509,225
Debt Service Limit	$ 1,866,667	$ 2,016,000	$ 2,177,280	$ 2,351,463	$ 2,539,577	$ 2,742,743
Capital Outlay for Education (12.5% of Direct General Expenditures	$ 4,257,963	$ 4,683,759	$ 5,152,135	$ 5,667,348	$ 6,234,083	$ 6,857,491

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posed by Farkel, the cost per classroom provided is $129,271 under the revised strategy, as contrasted to $137,134 under Farkel's approach. This is a consequence of greater use of pay-as-you-go financing and the size reduction proposed for the high school (and the consequent reduction in funds to be borrowed).

Table 6-11. Cost Comparison of Two Proposed Capital Improvements Programs for the City of Rurbania

Facility	Total Cost Including Total Debt Service	
	Farkel's CIP	Revised CIP
Woodrow Wilson E.S.	$2,196,780	$2,196,780
Harry S. Truman E.S.	2,372,630	2,965,710
James Madison E.S.	2,265,522	3,108,581
Samuel Adams E.S.	--	3,202,965
Rurbania Memorial H.S.	6,340,000	5,437,226
Capital Reserve Fund	2,284,900	2,336,283
Additions	2,410,284	2,612,475
Land Acquisition	2,100,000	2,510,000
Temporary Classrooms	600,000	450,000
Total Cost	$20,570,116	$24,820,020
Cost per Classroom	$137,134	$129,271

ENDNOTES

1. For a fuller discussion of these procedures see: Elizabeth Y. Dean, Financing Capital Improvements: The "Pay-As-You-Go" Approach (Berkeley: Bureau of Public Administration, University of California, 1961).

2. Advisory Commission on Intergovernmental Relations, State Constitutional and Statutory Restrictions on Local Governmental Debt, Report A-10 (Washington, D.C., September 1961), p. 24.

3. George H. Hempel, Measures of Municipal Bond Quality, Michigan Business Reports Number 53 (Ann Arbor: University of Michigan Bureau of Business Research, 1967), p. 21.

4. For a further discussion of these calculations see: Alan Walter Steiss, Local Government Finance: Capital Facilities Planning and Debt Administration (Lexington, Mass.: D.C. Heath and Company, 1975), pp. 123-125.

CHAPTER 7

MARKETING MUNICIPAL BONDS

Constitutional provisions, general statutes, special acts, and local charters that vary from state to state regulate the authorization and issuance of municipal bonds. Since controlling laws are not always conveniently codified, procedural steps necessary to secure the authorization of bonds often are confusing to local officials and administrators. Expert legal advice is important to insure compliance with all applicable legal requirements. Even minor errors may result in annoying delays, expensive litigation, and possible invalidation of issues or sales.

Preliminaries to Marketing

Some form of popular referendum is required in most states for the authorization of most types of bonds. In a few states there are optional provisions under which governing bodies may authorize bonds, within certain limits, without popular vote. Experience has shown, however, that this option should be used sparingly and held in reserve for emergencies. Occasionally, an issue may represent the unsold portion of a larger issue that had been previously authorized. In all cases, legal advice should be sought if any question exists as to the need for a public referendum.

The bond ordinance or resolution should be drawn with precision, setting forth, among other things, the nature and limits of the security offered. It is customary to submit such resolutions or ordinances to a bond attorney whose legal opinion will satisfy the market where the bonds are to be sold. The announcement of the issue (the official notice of sale) should specify that an unqualified approving legal opinion will be furnished to the buyer. While final approval cannot be given until the sale is complete, preliminary approval before bidding assures prospective buyers that the legal opinion can and will be furnished without delay.

Notice of Sale

An "Official Notice of Sale" should be published at least two weeks in advance of the date set for opening bids on the bond issue. Such notices generally are published in The Daily Bond Buyer, considered to be the industry's trade paper, and perhaps in regional bond publications. In some states, notices must also be placed in the official state newspaper.[1] Adequate publicity through the notice of sale given prospective bidders the opportunity to form their bidding accounts (syndicates) and to secure information regarding the offering. It also eliminates any suspicion of collusion and demonstrates that the municipality is willing to submit its financial condition to careful inspection. Such information is important to the bidding underwriters as they seek to determine an appropriate rate

of interest (coupon rate) that best fits the market. In some states, a maximum coupon rate may have been established and must be so stated in the notice of sale. To the extent possible within controlling state regulations, however, bidders should be permitted to bid different rates on various maturities or groups of bonds. This practice, known as "split-rate bidding", enables the underwriters to calculate the most favorable overall net interest cost for the municipality given the securities market.

Where state requirements mandate that municipal bonds be sold at par, supplemental coupons have been used to attract dealers when such restrictions limit the flexibility of bidding. Supplemental coupons are additional coupons attached to a municipal bond and covering the same interest period as one or more regular coupons (i.e., when a supplemental coupon is in force, the municipality is required to make two interest payments for that period). Supplemental coupons are usually detached by the underwriter at the time of original delivery from the issuer and may be held until the payment date or sold by the dealer at a discount. These coupons, in effect, represent the dealer's profit on the sale of the bond.

Bond Prospectus

The publication of all essential facts concerning the financial condition of the municipality is fully as important as any other factor in the successful marketing of municipal bonds. With the exception of revenue bond issues, however, no elaborate prospectus is necessary. The four-page statistical form, approved jointly by the Investment Bankers Association and the Municipal Finance Officers Association, usually is adequate. This form provides the information that most investors seek regarding debt and the provisions for payment, the adequacy of the community's revenue system and the effectiveness of its administration, the recent financial operations in the municipality, total tax rate and constitutional or statutory limits restricting debts or the taxes levied for their payments, population according to latest census data and a reliable estimate of present population, the the provisions that have been made for the payment of the principal and interest (i.e., the security that stands behind the bonds).

Revenue bonds require more extensive data to substantiate the earnings. Unless the facility has a well-established record of earnings, the investor will usually require the opinion of qualified engineers or other consultants experienced with the operations of such facilities. This feasibility report on the projected earning capacity, together with a copy of the bond ordinance or resolution setting forth protective convenants and other information, should be made a part of the official prospectus.

The bond prospectus should be printed and ready for distribution at the time of notice of sale. It should be sent, without request, to the investment bankers and other institutions that are interested in the

municipality's securities and to a select list of large investors. Financial papers which publish the paid notice about the sale will usually carry a news story about the community and, therefore, should also receive copies of the prospectus. Rating and information agencies should be given these data as well.

Timing of an Issue

The bond market experiences minor fluctuations within the course of every few months, brought on by an excess of supply over demand, as well as economic and political trends. By following municipal bond publications and consulting investment bankers, a municipality can avoid setting the date of sale in the midst of a general rush of new offerings (many large school bond issues, for example, reach the market in late spring and early summer), or immediately following large sales by other municipalities. It is unwise to enter the market too frequently (thus the advantage of a consolidated issue for general obligation bonds rather than separate issues for individual projects). If dealers have not completed the distribution of a previous issue from the municipality, a less satisfactory price on a new issue may be anticipated.

The due dates for semi-annual interest payments are determined by the date on which the bond is sold. Since there are certain times of the year for each municipality when its funds are low, the timing of an issue should be scheduled so that interest and principal payments do not come due at a time when funds are not in hand to pay them.

Miscellaneous Requirements

The largest buyers of municipal bonds are financial institutions that are exacting in their requirements. Failure to comply with their "rules of the game" tends to narrow the market and is reflected in the interest cost to the municipality. Where the bonds have a wide market, principal and interest should be payable in a large financial center, preferably at a bank located in a city where there is a Federal Reserve Bank or branch. Most large investors prefer to avoid the expense and inconvenience involved in collection of principal and interest payments outside such centers. Funds should be on deposit at the paying agent several days before the payments are due to ensure adequate time for the agent to prepare checks or bank drafts for payment when coupons are presented.

Costs Involved in Marketing Municipal Bonds

The cost of borrowing not only involves the interest payable over the term of the bonds, but also costs incurred in readying bonds for market and their actual delivery to the initial investors. Such costs reflect the expense of conducting a referendum, fees for various legal and financial advisors, and a variety of "miscellaneous" costs, including:

preparation and publication of bond notices and the bond prospectus; printing the bonds; obtaining a bond rating; costs of renting a signature machine used in signing the bonds; filing fees; court fees; registration or recording fees; certification costs; and costs of delivering the bonds. While some marketing expenditures may result in a broader sale, culminating in lower interest costs, other expenses may add little to the marketability of a bond issue.

In a recent survey of the Municipal Finance Officers Association of 481 governmental units in the United States and Canada, it was found that the average cost for marketing general obligation bonds amounted to $1.98 per $1,000, as compared to $3.84 per $1,000 for revenue bonds, and $5.13 for assessment bonds. As would be expected, the cost per $1,000 declines steadily as the size of the issue increases.

While no single cost incurred in the marketing procedure is large, in the aggregate these costs can amount to a considerable sum. The MFOA survey revealed that in some instances total marketing costs amounted to 5.5 percent of the value of the bonds. While these costs usually are paid from the bond proceeds, this practice reduces the amount available for the project or requires an increased borrowing to meet capital costs. In either case, interest costs also attach to that portion of the proceeds used to meet marketing costs.

Ratings for Municipal Bonds

Ratings have assumed considerable significance in determining interest rates and the eligibility of bonds for purchase by certain types of investors. Municipal bonds are rated only in terms of credit risk and not in terms of their investment merits. Bond ratings appraise two basic risk factors: (1) the risk that bond quality will be diluted by an inordinate increase in debt, and (2) the risk that ability to meet principal and interest payments may be impaired under depressed economic conditions.[2] The first risk is within the control of the issuing government, whereas the second is related to the impact of general economic conditions on a given locality.

In recent years, two major rating services -- Moody's Investors Service, Incorporated, and Standard and Poor's Corporation -- have classified into broad quality gradations approximately three-fourths of the total dollar amount issued in municipal bonds (slightly over 40 percent of the total number of bonds issued). These rating services use symbols, arranged in order from bonds with the least credit risk to those with the greatest risk, as shown in Table 7-1. Some issues rated by one service are not rated by the other, and the opinions of the two rating services may differ on specific issues. A third service, Fitch's Investors Service, rates some municipal bonds, using a rating symbol similar to that of Moody's.

Bond ratings are considered valid for one year or until the same issuer comes into the market again, whichever time is shorter. Generally speaking, there is only one rating for all of the general obligation bonds of a particular governmental unit and for all the municipal bond issues of

Table 7-1. Comparison of Municipal Bond Rating Systems

MOODY'S INVESTORS SERVICE	SYMBOL	SYMBOL	STANDARD AND POOR'S
Best quality; carrying smallest investment risk; referred to as "gilt edge"	Aaa	AAA	Prime: highest quality and lowest probability of default; quality management and low debt structure
High quality; rated lower than Aaa because margins of protection not as large	Aa	AA	High grade: only slightly less secure than prime; second lowest probability of default
Higher medium grade; many favorable attributes; some elements of future risk evident	A	A	Upper medium grade: safe investment; weakness in local economic base, debt burden, or fiscal balance
Lower medium grade; neither highly protected nor poorly secured; may be unreliable over any great length of time	Baa	BBB	Medium grade: lowest investment security rating; may show more than one fundamental weakness; higher default probability
Judged to have speculative elements; not well safe-guarded as to interest and principal	Ba	BB	Lower medium grade: speculative non-investment grade obligation; relatively high risk and uncertainty.
Lacks characteristics of desirable investment	B	B	Low grade: investment characteristics virtually nonexistent
Poor standing; issues may be in default	Caa	CCC	Defaults
Speculative in high degree; marked shortcomings	Ca	CC	Defaults
Lowest rated class; extremely poor prospects of ever attaining any real investment standing	C	C	Defaults

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a specific revenue project. Some governmental units or revenue projects have more than one rating because special security has been pledged for some of the bonds. New issues of a previously rated governmental unit or revenue project usually are assigned the same rating as the outstanding bonds unless there have been material changes in the credit situation. Therefore, new issues of a previously rated governmental unit or revenue project usually increase the dollar value outstanding in a rating category but rarely affect the number of municipal credits in a rating category.

The Bond Sale and Delivery

Municipal bonds may be purchased by underwriters in one of two ways: (a) in a private negotiated purchase, or (b) as the lowest bidder at competitive bidding. The law in most states requires that issuers sell general obligation bonds by competitive bidding, usually by submission of sealed bids. Even when negotiated sales are permitted, many bonds are sold by competitive bidding. There are many negotiated sales of revenue bonds because in such situations it often is advantageous to the issuer to have the underwriter participate in setting up the issue from the outset.

All bids made on a particular issue should be on a basis that permits a comparison of total cost to the issuer. Officials should insist that all bids comply strictly with the terms of the sale. All bids should be received and opened in public by the governing body at the designated hour, with the bonds awarded to the bidder on the basis of the lowest net interest cost. Good faith checks of all unsuccessful bidders should be returned promptly. All papers required to complete the bond transcript should be forwarded to the bond attorneys as soon as possible.

Before the bonds are delivered, information required to establish the bond register (sometimes called the bond and interest record) should be recorded. At the time a bond issue is sold, the interest due on each date of maturity should be computed and recorded, as should the payments of principal or payments into a sinking fund. With such records, a complete schedule of debt service requirements can be readily prepared for the current budget and for all outstanding debt obligations.

Bonds should be delivered at the earliest practical date after the sale (no later than thirty days); the winning bidder usually has the option to cancel his obligations if delivery is not made on or before the date specified in the contract. The purchaser should stipulate where the bonds should be delivered. Many municipalities prefer to have at least one official sign the bonds at point of delivery and to have the municipal seal imprinted at that time. Large bond issues usually are signed at the place of delivery because the travel expenses of officials frequently are less than the insurance on the delivery of signed bonds.

Summary

The marketing of municipal bonds is a complicated process, the mysteries of which, insofar as the uninitiated is concerned, are comparable to that of the stock market. Local officials must be mindful of the procedures for marketing bonds, from the planning of the issue through the actual delivery of the bonds to the winning bidder. Failure to adhere to these procedures can result in unnecessary delays, higher interest costs, and possible legal ramifications. As a practical matter, almost any bond issue that is in proper technical form can be sold at any time. However, whether a particular offering is "successful" at the date of sale depends on the congruence of many factors.

The municipal finance officer is caught in the middle, faced on the one hand by uncertainties as to the political and economic structure of the community and, on the other hand, by uncertainties of a marketplace that he may not fully comprehend. Adherence to accepted marketing procedures can go a long way to reducing the uncertainties that confront the municipal official from both sides. The success of a given issue may be determined by forces in the marketplace beyond the direct control of local officials; an awareness of these factors, however, can provide important insights in the overall planning of long-term bonds for capital facilities.

ENDNOTES

1. For a further discussion of the information to be included in an Official Notice of Sale and of municipal bond underwriting procedures, including illustrations of the calculus used by investment syndicates in the development of their bids, see: Alan Walter Steiss, Local Government Finance: Capital Facilities Planning and Debt Administration, chapter 7.

2. Alan Rabinowitz, Municipal Bond Finance and Administration (New York: Wiley -- Interscience, 1969), p. 75.

CHAPTER B

DEBT ADMINISTRATION

Debt administration was a relatively simple and routine task when long-term debt accounted for a small part of the total fiscal commitments of local government and consisted primarily of general obligation bonds. Each year an amount was set aside from general revenue sources sufficient to cover annual debt service, including monies to build an adequate sinking fund to yield the requisite principal payments at maturity. Most capital improvements were financed on a current funding basis and often merely subsumed under the annual operating budget.

The decade of the fifties, however, witnessed an unprecedented growth in general obligation debt, coupled with revenue bond financing, which previously had not been used extensively by local governments. These trends were further accelerated in the sixties and seventies. As a consequence, local governments have had to assume increased responsibility and accountability for the long-range administration of public debt.

Debt Records and Reporting

Annual reports concerning public debt are one of the weakest aspects of local financial administration. This shortcoming is unfortunate and unnecessary: unfortunate because such reports are critical to the basic credit rating of the municipality and are of interest not only to local officials and citizens but also to the holders of the municipality's bonds; and unnecessary because adequate debt records, as outlined below, facilitate the preparation of such reports, reducing this task to relatively simple procedures.

Adequate debt records must be maintained for two general purposes. First, accurate record keeping is vital to the short-term fiscal operations of government to avert the possibility of temporary default. Such record keeping must include maintenance of auditable ledgers as to the identity, purpose, and amount of all bonds, and the interest and principal payments made. Secondly, such records should make it possible to accurately determine the total debt service requirements over the full maturity of all issues so as to ascertain financial capacity to meet future capital requirements and to program the retirement schedule for any new borrowing.

These requirements can best be met through the establishment of a bond and interest register. The purposes of such a register are to collect in one place all pertinent information regarding individual bond issues, to assist in setting up a schedule of debt service requirements, and to collect information for posting to the bonded debt and interest payable ledgers.[1]

Principal and interest payable from general revenue sources must be distinguished from special assessment and revenue bonds payable from specific sources. Since general obligation bonds are totally dependent on annual revenue collections, the amount of unmatured bonded debt and the interest thereon should be carried in separate self-balancing accounts independent of any municipal funds.

Data on interest and principal requirements at each payment date and on the balance still outstanding should be computed for the entire life of the issue. From such a record, an overall schedule of debt service requirements can be readily computed, and a maturity and interest calendar can be compiled as a means of checking revenue needs for debt service on a month-to-month basis. As new issues are marketed, the calendar must be adjusted and updated.

The bonded debt ledger contains a sheet for each bond issue, showing the amount of bonds originally outstanding, the amount retired to date, and the balance outstanding. A separate sheet is similarly maintained for each bond issue in the interest payable ledger. As interest becomes payable, it is entered in the "credit" and "balance" columns, and as it is paid, the amount is entered in the "debit" column and the balance payable is reduced by a corresponding sum.

Financial Reporting

The annual financial report should contain, as a minimum, four types of statements regarding debt. First, there should be listing of all outstanding debt by issue, with issues broadly grouped according to purpose, i.e., general obligation, special assessment, revenue bonds, etc. For each issue the following information should be provided: date of issue, original amount, date of maturity, coupon rate, total interest, amount presently outstanding, and amount carried in sinking funds. All of this information can be taken directly from the bond and interest register.

For each broad classification of debt, information should be presented as to the annual schedule of debt service, including interest, amortization requirements, and total debt service. If term bonds are outstanding, there should be a sinking fund balance sheet, including the relation of sinking funds to actuarial requirements and a listing of current holdings. This second statement should also include data as to the level of unfunded debt, i.e., short-term borrowing that constitutes an obligation payable out of current revenues.

The third statement should show the overlapping debt of the community, i.e., that part of the debt of school districts, counties, townships, and special districts payable from taxes levied by the reporting jurisdiction. The fourth statement should be a computation showing the status of legal borrowing capacity.

If debt arising from the issuance of revenue bonds exists, the reporting process must include complete and factual information covering the facilities that support such debt. In addition to the general information outlined above, the report should include, as appropriate, the names of the corporate trustee, consulting engineers, and attorneys approving the legality of the issue. Most revenue bond ordinances also prescribe that a report be prepared annually by an independent certified public accountant, including a current balance sheet and a statement of any contingent liabilities not shown in the balance sheet. Particular types of revenue bonds, such as those for water or sewer facilities, often require supplemental information, such as average daily supply and consumption, storage capacity, number of customers, consumption per customer, method of billing, legal provisions, and so forth.

Accurate and complete financial reporting is essential to the development of confidence on the part of investors and the general public as to the management of a municipality's financial affairs. The returns will more than repay the relatively small amount of time and expense involved in the preparation of such reports. In addition to the annual report, an interim report covering much of the same information should be prepared midway in each fiscal year for distribution to those interested in the financial status of the municipality, i.e., nonresident investors as well as local citizens.

Tax Anticipation Borrowing

Short-term borrowing -- in the form of bank loans, sale of notes, or issuance and registration of warrants -- in anticipation of current taxes and other revenues has become a routine procedure in many local governments. Such borrowing could and should be eliminated, resulting in the saving of interest costs, which are particularly heavy when short-term money rates are high. Tax anticipation borrowing can be held to a minimum if the first tax due date is set to coincide with the beginning of the fiscal year and a quarterly or semi-annual installment method of tax collection is adopted. Many large cities operating under this approach have not had to borrow or issue warrants in anticipation of taxes for several decades.

Should a municipality find it necessary to borrow in anticipation of taxes, the loans sought should be of no longer duration than the period in which current taxes are to be collected, usually marked closely by the delinquency date or by some corresponding date for other revenues. If taxes are collected in installments, the loans should be for each period, or for such portion of it as necessary. The maximum amount of the loan should be governed by the amount of revenue anticipated. Sound management dictates that allowances be made for tax delinquency and that the level of borrowing be reduced accordingly. Unless delinquency is abnormally high, there is no justification for borrowing against delinquent taxes.

Emergency Borrowing

Nearly every municipality periodically is faced with the need to borrow on a short-term basis to meet unforeseen emergencies. The need to repair damage to public facilities resulting from storms, floods, or other natural catastrophes; unusually heavy demands for snow removal or "pot hole" repairs resulting from a severe winter; sudden, unanticipated shifts in particular operating expenses; or the award of a judgment against the city are all examples of such emergency expenses. Emergency borrowing supplies the needed funds which should then be provided for in the next budget unless the amount is so large as to require longer term financing.

Bond Anticipation Borrowing

If used with discretion, short-term borrowing in anticipation of the issuance of bonds may be a fiscally sound strategy in terms of a municipality's overall debt administration. Certain public improvements may be undertaken in stages, with bond anticipation notes issued as required to finance construction as the project progresses. When the improvement nears completion, or if a sizeable project, when temporary borrowing reaches some predetermined level, permanent long-term bonds may be issued and the temporary obligations retired. This procedure has the advantage of avoiding payment of interest on the full amount of funding until it is actually required. It also avoids the accumulation of idle funds and provides flexibility in choosing the most advantageous time to market long-term bonds. It may avoid the issuance of bonds in excess of requirements and, when used as a means of financing planning, engineering, and other preliminary studies, may even avoid the long-term bond issue if a project is delayed or abandoned.

Debt Service Payments

Prompt payment of all principal and interest requirements is the most direct evidence of sound debt administration and, consequently, the way in which a municipality administers its debt service is one of the most important factors in determining its credit standing for future borrowing. Even temporary defaults may adversely affect the municipality's ability to borrow at optimal interest rates.

It is not enough, however, merely to make the appropriate allocations for principal and interest payments in the annual budget; the allotment of funds must be so timed as to provide cash when it is needed. Thus budget officials must plan ahead to ensure that early payments required in the following year can be met, i.e., that a sufficient fund balance is carried over from the previous fiscal year and/or provision is made in the tax collection system to generate an adequate level of funds in the early part of the new fiscal year.

fiscal year and/or provision is made in the tax collection system to generate an adequate level of funds in the early part of the new fiscal year.

Management of Sinking Funds

A sinking fund provides the means of distributing the cost of principal repayment over the life of the issue so that irregular demands will not be made on the municipality's annual budget. Annual contributions are made into a segregated account which, when combined with the return from the investment of these account funds, provide an amount sufficient to cover the required principal when it comes due. The amount earmarked each year for the sinking fund should be determined by: (a) the amount of bonds to be retired, (b) the number of payments permitted by the term of the bonds, and (c) the anticipated rate of earnings of the invested funds.

In some states, municipalities are required to establish a fixed tax rate for sinking fund purposes. This tax is collected during the period in which the bonds are outstanding. This requirement has been criticized on the grounds that, over the term of such bonds, the tax base will be subject to side variations, and the result may be either excessive or inadequate funds. Others have argued that a "sinking fund tax" (or even better, a capital facilities tax) is sound in principle but greater flexibility is needed in the administration of such a tax.

A major difficulty in the use of sinking funds (and one contributing to the severe restrictions in many states) lies with the technical problems of managing the trust accounts, particularly in smaller communities where few persons may possess the specialized knowledge required to oversee such investments. Sinking fund requirements should be re-computed annually. If a surplus in excess of actuarial requirements should develop, it may be possible to lower future requirements. It is unwise, however, to effect a large reduction for a single year; rather, any significant surplus should be absorbed gradually over several tax periods. In the event of a deficit in the sinking fund, immediate steps should be taken to correct the situation.

In most states, municipalities are restricted by law to the types of sinking fund investments that can be made, usually being limited to federal, state, and municipal bonds.[2] Within these categories, investments should be limited to high-grade municipals and should exclude special assessment bonds and revenue bonds on enterprises with unproven earning power. The same type of analyses should be made of another municipality's offerings as investors make of the investing community's issue.

In addition to security, sinking fund investments must have liquidity--the maturities of the various investments must be so timed that funds will be readily available to retire the term bonds at maturity. Without careful investment planning, it may be

necessary to sell the holdings of the sinking fund in the open market, with the possibility of taking a loss. Greater flexibility often can be attained by investing in several different types and sizes of offerings, rather than a single set of securities.

The management of sinking funds often is a complex and difficult task--one that should not be undertaken without adequately trained personnel and proper safeguards to protect the integrity of the funds. Sinking funds remain as a viable means of financing many revenue-producing projects, however, whereby annual contributions to the fund are generated by the self-supporting facilities. In such cases, adherence to the guidelines outlined above is especially important, since such debts often are outside the protection of the full faith, credit, and taxing power of the municipality.

Recording and Cancellation of Coupons and Bonds

The final step in servicing and retiring a municipal debt involves the recording and cancellation of coupons and bonds that have been paid. After each payment date, coupons and bonds must be checked to determine if any have not been submitted for payment; some will always be slow in coming in, and occasionally, some may be permanently missing. Records of such items must be maintained until several years after the final maturity date in most cases. Cancelled bonds and coupons must be carefully filed, with bonds arranged by issue and number and coupons filed in serial order. Cancelled coupons and bonds are usually kept for several years, after which they are destroyed by shredding or burning. In recent years, many commercial banks and trust companies serving as paying agents for municipal bonds have expanded their services to cover all phases of recording and cancellation. These banks and trust companies provide the municipality with a certified list of the cancelled and cremated bonds and coupons. Many municipalities mandate that the disposition of these documents take place in the presence of the director of finance or the comptroller and at least one other municipal official. The "mortgage burning" ceremony is one that still has considerable significance for many small communities.

Defaults and Bond Refunding

Defaults on debt service, no matter how satisfactorily resolved, often result in a sharp decline in a municipality's credit standing, producing skepticism among lenders and major difficulties in negotiating favorable interest rates on future issues. Even temporary defaults, if allowed to extend beyond the normal 90-day grace period, may result in the removal of a city from the listing of securities approved for fiduciary investments.

Faced with the prospect of default on bonds or serious disruption of governmental operations, by reason of a sudden shift in

fiscal resources beyond local control, a municipality may find it necessary to refund (re-finance) outstanding debts.[3] Unfortunately, such forced refunding to avoid default frequently encounters unfavorable market conditions, since the economic factors that give rise to the need for refunding may be widespread. Under such circumstances, a municipality may be unable to sell refunded bonds to new investors but instead may be forced to negotiate with existing bondholders for the exchange of their holdings for new maturities. Since bonds may be widely held and bondholders difficult to locate, this can be a most cumbersome undertaking, particularly if the issue has undergone several transactions in the secondary trading market.

By far the largest number and most severe municipal defaults took place during the depression era, when approximately $5.5 billion, or 30 percent of the average municipal debt outstanding, was in default. Prior to 1930, municipal debt had increased at a very significant rate as a consequence of speculative overdevelopment of real estate and a lack of realistic debt limitations.[4] As wealth, income, and assessed values plunged downward in the early years of the depression, municipal revenues also declined rapidly. The decrease in tax revenues, for which there were no adequate substitute, was not accompanied by commensurate declines in expenditures. Many governments were confronted with rising debt service charges, the result of unwieldy debt structures contracted in the past, and with increased operating costs, including demands for unemployment relief payments. While some municipalities were able to borrow enough to cover their operating deficits, this borrowing added to the already large fixed charges of these communities. In 1932 and 1933, municipal borrowing was greatly curtailed as a consequence of rapidly rising interest costs, bank failures, and loss of public confidence in municipal bonds. Therefore, many municipalities with deficit budgets were forced to default.

Types of Defaults

Minor and temporary defaults involve a failure to meet the maturity payment of a single security or temporary postponement of interest payments. Such short-term defaults may be the result of unanticipated declines in revenue collections, the shutting off of normal lines of bank credit, and/or a temporary inability to market refunding bonds. Minor defaults can usually be corrected without disturbing the general debt structure or further interrupting debt service. Adjustment strategies include: (a) payment during the grace period from belated tax receipts, (b) short-term bank loans, (c) small issues of refunded bonds, or (d) exchanges of securities.

A second, more serious class of defaults involves municipalities that have encountered such fiscal problems as peak debt service in periods of low-paying capacity, serious breakdowns of local industries, and/or abnormally high tax delinquency. Under such circumstances,

the municipality may experience difficulties in meeting current accounts as well as long-term obligations. Adjustments usually are effected by refunding or partial refunding a few years' obligations in order to free up some fiscal resources to meet current operating costs. This may be accomplished without material disturbance of the general debt structure and without any scaling of debt. Once current obligations are returned to a more balanced basis, attention can be redirected toward long-term obligations which may require further readjustments to reflect sound debt administration principles.

The third class of defaults, which fortunately has occurred infrequently since the thirties, involves situations in which the municipality is confronted by abnormally high debt, severely curtailed revenues, and unwieldy accumulation of operating deficits, with little or no prospect for correction except through a comprehensive refunding plan. Such a plan usually involves not only a complete reconstruction of the entire debt retirement schedule but also a scaling down of interest and even principal payments. The scaling of debt (i.e., actual reduction in the municipality's commitments) becomes necessary when the total obligation is clearly beyond the local government's capacity to pay. Investors are naturally reluctant to forego any portion of their contractual rights and particularly so with regard to principal. Unless the situation is hopeless, they tend to prefer extensive postponements. Thus, when necessary, scaling can be more readily accomplished through a reduction in interest rates.

Insofar as possible, a municipality should take the initiative in readjustment and in planning and implementing the refunding plan. While serious defaults require time for careful investigation and deliberation before commitments are made, immediate and continuing action indicates both competence and good faith and may gain the necessary cooperation from investors to successfully resolve the pending financial crisis.

To be successful, the refunding plan must first provide mechanisms to release current accounts from accumulated deficiencies, placing them on a balanced basis. A method of financing municipal operations should be adopted that will assure, as far as reasonably possible, the continuation of this balanced status. While a brief hiatus from full debt service may be necessary, such postponement of obligations is valid only if it is used as a means of rehabilitating the current accounts. Such refunding as is necessary should postpone the retirement of as little debt service as possible; the replanning of the debt structure should not trade a difficult immediate situation for an impossible future one.

Summary

Debt administration is one of the most significant responsibilities of local government officials. It requires that comprehensive and systematic procedures be established for the maintenance of records for annual financial reporting, and for the accountability of funds. Such procedures are essential to develop confidence on the part of investors and the general public as to the overall management of a municipality's financial affairs.

Prompt payment of all debt service charges is the most direct evidence of sound debt administration. To achieve this objective, it is necessary to establish an information system regarding interest and redemption requirements over the life of all outstanding issues. The management of sinking funds or other debt service funds may form a critical part of the debt administrator's responsibilities. Recording and cancellation of coupons and retired bonds must be undertaken in an orderly manner to insure the proper closing out of debt obligations.

Finally, the procedures of refunding and the safeguards against defaults should be clearly understood by local officials. While most states have adopted legislative measures to circumvent the financial responsibility still rests with officials of local government to adopt debt administrative procedures that will protect their community from "mortgaging its future."

Case Study #5: Debt Administration

Rising costs for government operations resulting from the impact of inflation, coupled with increased personnel costs, have brought the City of Rurbania to a critical fiscal position. While the City Council has been able to maintain a balanced budget (i.e., has not been forced to resort to deficit financing), there is a general reluctance among members of the Council to increase local taxes or to adjust fee schedules adequately to compensate for the rising costs of government. Instead, greater reliance has been placed on intergovernmental transfers to meet the expanding demands for new and improved public services and facilities.

As noted in the analysis of Rurbania's revenues and expenditures (case study #3), one of the agencies that has been operating in the "red" in recent years as a consequence of the reluctance of the City Council to increase user fees is the Rurbania Sewer and Water Utility Commission (RSWUC). Although the Commission operates as a special authority, i.e., is expected to be a self-supporting enterprise and is empowered to issue bonds secured by the revenues raised through user charges, its activities still fall within the general budgetary jurisdiction of the City Council. As noted in Joe Furd's analysis, the Sewer and Water Utility Commission showed a deficit of $390,375 during the past fiscal year, with operating expenditures of $2,816,000 and revenues of $2,425,625. Added to this operating deficit was the $507,000 commitment to capital construction projects.

Furd's recommendation to adjust the fee schedule to increase the returns from the Commission's operations by ten percent would still leave a deficit in excess of $250,000. As in the past few years, such deficits would have to be covered from the agency's surplus funds (accumulated in years when the fee schedule was appropriately structured to meet operating and capital costs) or from general revenues.

Arnold Trunion, a budget analyst in the office of the City Manager, was assigned the responsibility to analyze the further implications of this continuing deficit and to formulate recommendations regarding additional necessary adjustments. Trunion's first step was to organize a more detailed statement of the income and expenses expected in the current fiscal year, as shown in Table B-1.

The Commission derives a major portion of its operating revenues (74 percent) from the sale of water. In this connection, the Commission has three basic types of "customers": (1) households, small businesses, etc., that have their water supplied metered; (2) large consumers (industries, commercial establishments, institutions, large apartment complexes) that purchase water on a flat rate basis; and (3) sales to other small water utilities in the surrounding county. For the current fiscal year, Trunion projected that $2,039,535 would be derived from these sources (the basis for his estimates are shown in Table B-3).

TABLE 8-1.--Rurbania Sewer and Water Utility Commission
Statement of Income and Expenses

Operating Revenues:		
Sale of Water:		
Metered Sales to General Customers		$1,410,820
Flat Rate Sales		383,715
Sales to Other Water Utilities		245,000
Subtotal		$2,039,535
Sewer Use Fees		
Metered Customers (@ 30%)		423,246
Flat Rate Customers (@ 25%)		95 929
Other Revenues		
Fire Protection Fund Transfer		70,000
Rent from Commission Properties		54,400
Customers' Forfeited Discounts and Penalties		15,550
Servicing of Customers' Installations		20,250
Merchandising, Jobbing, and Contract Work		31,090
Subtotal	$	191,290
Total Operating Revenues		$2,750,000
Less Operating Expenditures:		
Operating Expenses		$2,625,628
Depreciation		300,000
Taxes (6% of $2,039,535)		122,372
Subtotal		$3,048,000
Operating Income		- $ 298,000
Plus Non-Operating Income:		
Interest on Bank Deposits ($200,000 @ 4.5%)	$	9,000
Interest on Investments ($200,000 @ 6.0%)		12,000
Rent from Non-Operating Property		455,400
Sinking Fund Income		66,507
Subtotal	$	542,907
Total Operating and Non-Operating Income		$ 244,907
Deduct Non-Operating Expenses		
Payment to Sinking Fund	$	100,000
Debt Service Charges		397,000
Subtotal	$	497,000
Net Income		- $ 252,093

A second source of revenue are the sewer use fees, which are based on the volume of water used by the various types of customers. Metered customers pay a 30 percent surcharge, while flat rate customers pay a 25 percent surcharge. Use fees account for 18.9 percent of the total operating revenues of RSWUC. A recent study developed in conjunction with the conversion of the city's budget to a programmatic basis, however, showed that sewerage collection and treatment account for nearly 30 percent of the operating costs of the Commission

Other revenues are derived from: (1) an interagency transfer of funds ($70,000) to support the water supply for fire protection; (2) rentals on Commission properties (a limited number of recreation sites are available adjacent to the reservoir sites); (3) forfeited discounts and penalties (service charges) on unpaid bills; (4) the charges for installing and servicing meters, initiating and terminating services, etc.; and (5) various types of miscellaneous services provided to customers (such as water softeners, land sprinkling systems, special high velocity water pumps for irrigation, and so forth).

Trunion developed the basic fee schedule shown in Table 8-2 to incorporate the ten percent increase recommended by Joe Furd and accepted with some reluctance by the City Council to be effective in the current fiscal year. As this table shows, the fee schedule for metered service is based on a graduated scale; beyond 5000 gallons per month each additional 1000 gallons cost slightly less, until the 20,000 gallon level is reached, at which point the customer is eligible for the flat rate. The average customer (household) used 8,000 gallons per month during the past fiscal year. Trunion projected that this average consumption would increase to 8,500 gallons monthly in the current fiscal year. Trunion estimated that there would be 23,420 metered customers, resulting in a total annual consumption of 2,388,840,000 gallons. Approximately 775,180,000 gallons were distributed during the past fiscal year to flat rate customers. Trunion projected a ten percent increase in this consumption, or 852,700,000 gallons, for the current fiscal year. According to the RSWUC Executive Director, the current capacity of the utility is 3.8 billion gallons. Thus, some 558,460,000 gallons would be available for sale to other utilities, for use in fire fighting, and so forth. During the past fiscal year, some 14,000,000 gallons were required for fire protection.

As shown in Table 8-1, Trunion estimated that all sources of operating revenue would amount to $2,750,000. From this figure operating expenditures must be subtracted--the largest single item being for actual operating expenses, amounting to $2,625,628 for the current fiscal year (salaries and wages, materials and supplies, fuel costs, maintenance, etc.). By state law, the Commission must set aside a depreciation allowance for the future replacement of its capital facilities. The State Utility Commission levies a tax on the sale of water by any public

TABLE 8-2.--Rurbania Sewer and Water Utility Commission
Basic Fee Schedule for Metered Users

Monthly Gallons Metered	Rate per 100 Gallons	Billing Charges
1000	$0.060	$0.60
2000	$0.060	$1.20
3000	$0.060	$1.80
4000	$0.060	$2.40
5000	$0.060	$3.00
6000	$0.059	$3.59
7000	$0.058	$4.17
8000	$0.057	$4.74
9000	$0.056	$5.30
10000	$0.055	$5.85
11000	$0.054	$6.39
12000	$0.053	$6.92
13000	$0.052	$7.44
14000	$0.051	$7.95
15000	$0.050	$8.45
16000	$0.049	$8.94
17000	$0.048	$9.42
18000	$0.047	$9.89
19000	$0.046	$10.35
20000 & over*	$0.045	$10.80

*Utility customers using 20,000 gallons per month or more are charged at a flat rate of $0.045 per 100 gallons.

utilities (six percent of gross sales), which according to Trunion's calculations will amount to $122,372 for the current fiscal year. These expenditures amount to $3,048,000, leaving an operating deficit of $298,000.

The Commission also derives income from interest on its investments and bank deposits, from the sinking fund established to pay off an outstanding term bond (see Table 8-4), and from a former reservoir site which is still owned by the Commission and leased on a purchase option basis. The Commission's modest reserve of $400,000 is invested in five year municipal debentures ($200,000 earning six percent annually) and held on deposit in a local bank for emergency purposes ($200,000 earning 4.5 percent).

TABLE 8-3.--Rurbania Sewer and Water Utility Commission
Projected Demands and Resulting Revenues from Sale of Water.

	t - 1	t	t + 1	t + 2	t + 3	t + 4
Number of Metered Customers	22,890	23,420	23,960	24,510	25,075	25,650
Average Monthly Consumption	8,000	8,500	8,925	9,270	9,840	10,330
Total Annual Consumption (billion gallons)	2.19744	2.38884	2.56612	2.75590	2.96086	3.17957
Average Monthly Billing	$4.30	$5.02	$5.26	$5.50	$5.76	$6.03
Average Revenues from Metered Sales	1,181,125	1,410,820	1,512,355	1,617,660	1,733,184	1,856,034
Flat Rate Consumption	0.77518	0.85270	0.93797	1.03177	1.13494	1.24844
Annual Revenues (@ $0.04/100 gallons) (@ $0.045/100 gallons)	310,000	383,715	422,086	464,296	510,723	561,798
Total Local Consumption (billion gallons)	2.97262	3.24154	3.50409	3.78767	4.09580	4.42801
Gallons Available for Other Utilities	0.82738	0.55846	0.29591	0.01233	-0.29580	-0.62801

Current Fiscal Year = t

Policy/Program Analysis
and Evaluation Techniques

TABLE 8-4.--Rurbania Sewer and Water Utility Commission
Payment Schedule for 15 Year Sinking Fund to
Yield $2,000,000 at Four Percent Return

Fiscal Year	Annual Payment	Accumulative Total	Interest (@ 4.0%)	Total Carried to Next FY
t -12	$100,000	$100,000	$ 4,000	$104,000
t -11	100,000	204,000	8,160	212,160
t -10	100,000	312,160	12,486	324,646
t - 9	100,000	424,646	16,986	441,632
t - 8	100,000	541,632	21,665	563,297
t - 7	100,000	663,297	26,532	689,829
t - 6	100,000	789,829	31,593	821,422
t - 5	100,000	921,422	36,857	958,279
t - 4	100,000	1,058,279	42,331	1,100,610
t - 3	100,000	1,200,610	48,024	1,248,634
t - 2	100,000	1,348,634	53,945	1,402,579
t - 1	100,000	1,502,579	60,103	1,562,682
t	100,000	1,662,682	66,507	1,729,189
t + 1	100,000	1,829,189	73,168	1,902,357
t + 2	97,643	2,000,000	--	--

$$S.F. = \$2,000,000 \times \frac{.04}{(1.04)^{15} - 1} = \$100,000 \quad (\$99,882)$$

Twelve years ago, the Commission issued $2,000,000 in term bonds, carrying a 4.75 percent interest rate for 15 years, in order to construct a new primary treatment facility. Each year, the debt service charges on these bonds is $95,000, in addition to which the Commission must make an annual payment of $100,000 to the sinking fund which has been established to accumulate the bond principal. This sinking fund currently is earning 4 percent on the accumulated investment (or approximately $66,500 for the current fiscal year). As shown in Table 8-1, the addition of non-operating income from various sources leaves the Commission with a net of $244,097. However, from this figure must be deducted the nonoperating expenses that represent the Commission's capital commitments.

Two years after the issue of the term bonds, the Commission was forced to issue a second revenue bond to up-grade its water supply system. This bond of $2 million was placed on a straight serial basis, with the principal paid down in equal installments over 20 years. These bonds carry a coupon rate of five percent on the unpaid principal (see Table 8-5 for the schedule of debt service charges). The debt service in the current fiscal year will be $150,000.

TABLE 8-5.--Rurbania Sewer and Water Utility Commission Debt Service Charges on 20-Year Revenue Bond, Straight Serial with Principal Paid in Equal Installments at Five Percent Interest

Fiscal Year	Principal Outstanding	Interest Payments	Principal Payments	Total Oebt Service
t -10	$2,000,000	$100,000	$100,000	$200,000
t - 9	1,900,000	95,000	100,000	195,000
t - 8	1,800,000	90,000	100,000	190,000
t - 7	1,700,000	85,000	100,000	185,000
t - 6	1,600,000	80,000	100,000	180,000
t - 5	1,500,000	75,000	100,000	175,000
t - 4	1,400,000	70,000	100,000	170,000
t - 3	1,300,000	65,000	100,000	165,000
t - 2	1,200,000	60,000	100,000	160,000
t - 1	1,100,000	55,000	100,000	155,000
t	1,000,000	50,000	100,000	150,000
t + 1	900,000	45,000	100,000	145,000
t + 2	800,000	40,000	100,000	140,000
t + 3	700,000	35,000	100,000	135,000
t + 4	600,000	30,000	100,000	130,000
t + 5	500,000	25,000	100,000	125,000
t + 6	400,000	20,000	100,000	120,000
t + 7	300,000	15,000	100,000	115,000
t + 8	200,000	10,000	100,000	110,000
t + 9	100,000	5,000	100,000	105,000
Totals		$1,050,000	$2,000,000	$3,050,000

Five years ago, the Commission issued yet another revenue bond on a straight serial basis, with a 15 year maturity and carrying a coupon rate of 5.2 percent on the unpaid balance. For the current fiscal year, as shown in Table 8-6, the debt service charges for this issue will be $152,000.

Thus the non-operating expenses of the Commission for the current fiscal year will total $497,000. Deducting these expenses from the total operating and non-operating income results in a deficit of $252,093.

In an effort to eliminate at least a part of this deficit, Trunion recommended that the surcharge for sewer use be increased to 35 percent for both metered and flat rate customers and that the flat rate fee for other utilities be increased from $0.045 per 100

TABLE 8-6.--Rurbania Sewer and Water Utility Commission Debt Service Charges on 15-Year Revenue Bond, Straight Serial with Principal Paid in Equal Installments at 5.2 Percent Interest

Fiscal Year	Principal Outstanding	Interest Payments	Principal Payments	Total Debt Service
t - 5	$1,500,000	$78,000	$100,000	$178,000
t - 4	1,400,000	72,800	100,000	172,800
t - 3	1,300,000	67,600	100,000	167,600
t - 2	1,200,000	62,400	100,000	162,400
t - 1	1,100,000	57,200	100,000	157,200
t	1,000,000	52,000	100,000	152,000
t + 1	900,000	46,800	100,000	146,800
t + 2	800,000	41,600	100,000	141,600
t + 3	700,000	36,400	100,000	136,400
t + 4	600,000	31,200	100,000	131,200
t + 5	500,000	26,000	100,000	126,000
t + 6	400,000	20,800	100,000	120,800
t + 7	300,000	15,600	100,000	115,600
t + 8	200,000	10,400	100,000	110,400
t + 9	100,000	5,200	100,000	105,200
Totals		$624,000	$1,500,000	$2,124,000

gallons to $0.05 per 100 gallons. He calculated that these adjustments in fees would net an additional $136,134, leaving a deficit of $115,959 to be paid from the Commission's reserves.

Demand and Output Expectations

In discussions with the Supervising Engineers and other key RSWUC personnel, it was suggested that average household consumption may be expected to increase by five percent per year over the next several years as additional household appliances requiring larger quantities of water (air conditioners, dishwashers, garbage disposals, etc.) become more widespread in their use. Population projections prepared by the Department of Planning and Budget would indicate an annual average increase of 2.3 percent in terms of the number of households tied into the RSWUC services. It was also suggested by Commission personnel that the level of consumption by flat rate customers will increase at an average rate of ten percent per year over the next five years.

Given these estimates of demand, Trunion was now in a position to prepare projections of operating revenues arising from the sale

of water and sewer use fees, assuming a fixed supply, i.e., that the current output of 3.8 billion gallons represented the full capacity of production of the existing reserviors and public wells. Under this assumption, any increase in demand from Rurbania customers will have to be met by proportionate reductions in the sale of water to other utilities. In making these initial projections, Trunion assumed that the "basic fee schedule" shown in Table 8-2 would remain in effect.

As shown in Table 8-3, in three years not only will there be no surplus for sale to other water utilities, but the current level of output will be insufficient to meet the projected demands of customers within Rurbania. The anticipated income resulting from these projections is shown in Table 8-7. In preparing these income estimates, Trunion assumed that the interagency transfer of funds to support the water supply for fire protection would remain at $70,000, while the quantity of water required would increase by 2.3 percent per year to parallel the increase in population.

TABLE 8-7.--Rurbania Sewer and Water Utility Commission
Projected Revenues from Sale of Water and Sewer Fees

	t	t + 1	t + 2
Metered Customers	$1,410,820	$1,512,355	$1,617,660
Flat Rate Customers	383,715	422,086	464,296
Sewer Fees (35% Surcharge)	628,087	677,054	728,685
Fire Protection	70,000	70,000	70,000
Sale to Other Utilities	272,222	140,629	--
Totals	$2,764,844	$2,822,124	$2,880,641
Percent Increase		2.07%	2.07%

Trunion carried his analysis two years into the future, at which time the demand for water for fire protection would eliminate any surplus supply for sale to other utilities. From Table 8-7 it may be noted that the annual rate of increase in revenues is only 2.07 percent. While the expense of non-operating commitments will

decline during this period, the projected rate of increase in revenues from the sale of water and sewer fees will be insufficient to offset the anticipated increases in operating costs, thereby resulting in even further deficits.

The calculations leading to estimates of the deficits for these three fiscal years are summarized in Table B-8. In developing the projections of "other water revenues," Trunion assumed that the income generated by forfeited discounts and penalties, the servicing of customers' installations, and from merchandising, jobbing, and contract work would increase at the same rate as that of the number of customers serviced (i.e., 2.3 percent per year). The rental contract on RSWUC properties includes an annual five percent acceleration clause. Data on sinking fund income are taken directly from Table 8-4. In calculating the interest on bank deposits and investments, Trunion assumed that any deficits would be made up first from bank deposits and then by liquidating investments.

Trunion assumed an annual increase of ten percent in operating expenses to take into account the rising cost of labor, materials and supplies and other impacts of inflation plus the cost of servicing increased numbers of customers. The depreciation schedule adopted by the Commission calls for an annual decrease in depreciation payments at the rate of five percent. The State Utility Commission will continue to levy a six percent tax on the water sales of RSWUC. Data on non-operating expenses were adopted from Tables 8-4, 8-5, and 8-6.

From these preliminary calculations, Trunion determined that the deficit would increase by more than 3.5 times over the next three years unless some further adjustments were made in the basic fee schedules. As a temporary solution, Trunion proposed that a ten percent surcharge be initiated beginning January 1, to be applied to the monthly bills of all metered and flat rate customers and that the flat rate charge for sale of water to other utilities be raised to $0.06 per 100 gallons on that date (i.e., the equivalent of a 20 percent annual increase). As shown by the following calculations, these adjustments would eliminate the estimated deficit for the current fiscal year and provide a small surplus.

Anticipated Income from Local Sales (Jan. thru June)	= $B97,268
10% Surcharge	x .10
Additional Revenue	= $ 89,727
Additional Taxes (6%)	= 5,384
Net Gain	$ 84,343

Anticipated Income for Sale of Water to Other Utilities (Jan. thru June)	= $136,111
20% Surcharge	x .20
Additional Revenue	$ 27,222
Additional Taxes (6%)	1,633
Net Gain	$ 25,589

TABLE 8-8.--Rurbania Sewer and Water Utility Commission
Estimated Revenues, Expenditures, and Deficits

	t	t + 1	t + 2
Revenues:			
Sale of Water and Sewer Fees	$2,764,844	$2,822,124	$2,880,641
Other Revenues	66,890	68,428	70,000
Rent from Commission Properties	509,800	535,290	562,055
Sinking Fund Income	66,507	73,168	--
Interest on Bank Deposits	9,000	3,708	--
Interest on Investments	12,000	12,000	758
Total Revenues	$3,429,041	$3,514,718	$3,513,454
Expenditures:			
Operating Expenses	$2,625,628	$2,888,191	$3,177,010
Depreciation	300,000	285,000	270,750
Taxes	124,005	124,504	124,917
Non-Operating Expenses	497,000	486,800	474,243
Total Expenditures	$3,546,633	$3,784,495	$4,046,920
Estimated Deficit	$ 117,592	$ 269,777	$ 533,466

Anticipated Additional Income from Local Sales	= $ 89,727
35% Surcharge	= x .35
Additional Revenues from Sewer Fees	$ 31,404
Total Additional Revenues	= $141,336
Less: Projected Deficit	= 117,592
Surplus	= $ 23,744

Assuming that these temporary fee schedule adjustments would remain in effect for the next two years (or become permanent adjustments), Trunion made similar calculations for the following two fiscal years, as summarized in Table 8-9. He also assumed that beginning in the next fiscal year, the interagency transfer for fire protection would be increased to $75,000. While these adjustments would result in a surplus of $17,922 in the next fiscal year, the loss of revenue

TABLE 8-9.--Rurbania Sewer and Water Utility Commission
Adjusted Revenue and Expenditure Estimates

	t	t + 1	t + 2
Revenues:			
Sale of Water and Sewer Fees	$2,843,197	$3,041,400	$3,091,705
Interagency Transfer	70,000	75,000	75,000
Other Revenues	66,890	68,428	70,000
Rent	509,800	535,290	562,055
Sinking Fund Income	66,507	73,168	--
Bank Deposit Interest	9,000	9,000	9,000
Interest on Investments*	12,000	13,425	14,500
Total Revenues	$3,577,394	$3,815,711	$3,822,260
Total Expenditures	$3,553,650	$3,797,789	$4,059,412
Surplus or Deficit	+$ 23,744	+$ 17,922	-$ 237,152

from the sale of water to other utilities, coupled with the loss of income from interest on the sinking fund, results in a deficit of $237,152 for the fiscal year thereafter (t + 2).

Development of Additional Supply Capacity

In consultation with the Executive Director and Supervising Engineers of RSWUC, Trunion determined that the current capacity of the water utility output could be increased by 6.0 percent per year with an annual investment of $100,000 over the next five years. This funding would be used for the development of new public wells and the expansion of the existing capacity of the reservoirs. As shown in Table 8-10, this increased capacity would permit the RSWUC to serve the projected demands of Rurbania customers over the next 6 years, while maintaining a small surplus for sale to other utilities.

*Trunion assumed that the surpluses would be invested in short-term municipal debentures.

TABLE 8-10.--Rurbania Sewer and Water Utility Commission
Output Capacity at a 5 Percent Annual Rate of Expansion

	t	t + 1	t + 2	t + 3	t + 4	t + 5
Total Output in Billions of Gallons	3.80000	4.02800	4.26968	4.52586	4.79741	5.08526
Projected Rurbania Demand	3.25586	3.51874	3.80266	4.11113	4.44370	4.80483
Surplus for Sale	0.54414	0.50926	0.46702	0.41473	0.35371	0.28043

Assuming that all of the surplus supply would be sold to other utilities, Trunion calculated that these additional revenues generated by these sales would more than cover the annual cost of $100,000 required to achieve the expanded capacity, as shown in Table 8-11.

TABLE 8-11.--Rurbania Sewer and Water Utility Commission
Additional Revenues Generated from Sale of Surplus

	t + 1	t + 2	t + 3	t + 4	t + 5
At $0.06 per 100 gallons	$305,556	$280,212	$248,838	$212,226	$168,258

Trunion's calculations are summarized in Table 8-12. On the basis of this analysis, he made the following recommendations:

(1) An increase in the sewer fee surcharge for both metered and flat fee customers from the present levels to 35 percent.

(2) A permanent 10 percent increase in the basic fee schedule for Metered Customers and an increase in the flat rate fee from $0.045 per 100 gallons to $0.0495 per 100 gallons, effective January 1.

(3) An increase in the flat rate charges for sale to other water utilities from $0.05 per 100 gallons to $0.06 per 100 gallons.

TABLE 8-12.--Rurbania Sewer and Water Utility Commission
Projected Revenues and Expenditures.

	t + 1	t + 2	t + 3	t + 4	t + 5
Revenues:					
Local Sale of Water	$2,127,885	$2,290,162	$2,468,298	$2,659,615	$2,868,820
Sewer Fees	744,760	801,553	863,904	930,065	1,004,087
Sale of Water to Other Utilities	296,765	280,212	248,838	212,226	168,258
Other Revenues	68,428	70,000	71,610	73,257	74,942
Transfers for Fire Protection	75,000	75,000	75,000	75,000	75,000
Rent from Commission Properties	535,290	562,055	590,158	619,666	650,649
Sinking Fund Income	73,168	--	--	--	--
Bank Deposit Interest	9,000	9,000	5,736	5,736	4,531
Interest on Investment	13,425	15,720	15,720	18,894	18,894
Total Revenues	$3,943,721	$4,103,692	$4,339,264	$4,595,259	$4,865,181
Expenditures:					
Operating Expenses	$2,888,191	$3,177,010	$3,494,711	$3,844,182	$4,228,600
Depreciation	285,000	270,750	257,213	244,352	232,134
Taxes (6%)	145,479	154,222	163,028	172,310	182,225
Non-Operating Expenses	486,800	474,243	271,400	261,200	251,000
Capacity Expansion	100,000	100,000	100,000	100,000	100,000
Total Expenditures	$3,905,470	$4,176,225	$4,286,352	$4,622,044	$4,993,959
Surplus or Deficit	$ 38,251	$ 72,533	$ 52,912	$ 26,785	$ 128,778

(4) An increase in the interagency transfer for water supply for fire protection from $70,000 to $75,000 effective in the coming fiscal year.

(5) Authorization of an annual commitment of $100,000 for the next five years to finance the expansion of the existing water supply capacity at an annual rate of 6 percent.

(6) Consideration of a further 10 percent increase in the basic fee schedule within the next five years.

Scenario #5: Debt Administration

A longer term solution to the water supply capacity problem in Rurbania would involve the development of new reservoir facilities. Arnold Trunion considered this alternative early in his analysis, but he concluded that the cost of such a project--$3.5 million--would be prohibitive given the current deficits facing the Commission. The reservoir development project, as proposed by the RSWUC staff, would add some 2.2 billion gallons to the annual capacity of the water supply system and would require an estimated two years to construct. A site for the project near the existing reservoir has been identified, and transmission and distribution line tie-ins are included in the $3.5 million cost estimate.

A major factor in Trunion's initial rejection of this alternative was the uncertainty surrounding the future funding of the project. In addition to the basic debt service charges required if a revenue bond were to be issued to fund the project, it would be necessary to establish a debt service reserve fund, equivalent to one year's maximum principal and interest requirements, and a renewal and replacement fund to provide repairs beyond normal maintenance. For current projects, these fund requirements are covered by the RSWUC's annual contribution to the depreciation fund. Trunion estimated that in the first five years of the project approximately $350,000 (or ten percent of the total cost) would be required to establish these funds (or $70,000 per year). Further, there is the front-end costs of preparing for such a bond issue which would have to be met out of current operating revenues. Trunion estimated this cost to be approximately $6.00 per $1,000 or $21,000. Thus, assuming the issuance of a revenue bond under conditions similar to those which prevailed with the most recent revenue bond issue (i.e., straight serial with 15-year maturity at 5.2 percent interest), the total package would cost $5,327,000.

Trunion reasoned that these costs would have to be largely met through the sale of water to other utility companies, since the additional supply capacity would not be required in Rurbania for

the next four to five years. While these other small utilities presently purchase in excess of 500 million gallons annually and have in the past purchased as much a 750 million gallons annually, the diminishing surplus of the RSWUC has forced these smaller utilities to look elsewhere for a portion of their supply. There have been some discussions among representatives of these smaller utilities regarding the cooperative development of their own reservoir and supply system. There are, however, certain advantages to these utilities under the present arrangement. Even with the proposed increase in the flat rate cost to $0.06 per 100 gallons, the small utility companies can make a "profit" from the sale of Rurbania water to their customers since they do not have the fixed capital costs for the supply system and the water purification facilities.

Using the data developed in the case study, the scenario assignment is to explore this alternative further to determine if Trunion was correct in his initial decision to eliminate the development of an additional reservoir from further consideration on the basis of cost constraints. In developing the analysis, it may be assumed that all of the recommendations made by Trunion are adopted by the Rurbania Sewer and Water Utility Commission and by the Rurbania City Council. It may be further assumed that the small utilities in the county would be willing to purchase up to 750 million gallons annually if such a surplus were available. In developing recommendations, consideration may be given to various contractual or organizational arrangements between RSWUC and the other utility companies. The options available for the issuance of revenue bonds are shown below in Table 8-13.

TABLE 8-13.--Interest Rates on Various Types of Revenue Bonds

Type	Maturity	Interest Rate
Straight Serial	10	5.30%
Straight Serial	15	5.20%
Straight Serial	20	4.90%
Annuity Serial	10	5.25%
Annuity Serial	15	5.00%
Annuity Serial	20	4.85%
Term Bond*	10	5.00%
Term Bond*	15	4.85%
Term Bond*	20	4.50%
Deferred Principal (Five Years)	15	5.25%
Deferred Principal (Five Years)	20	5.00%

*Assume that the Sinking Fund for all term bonds will earn 4.5 percent interest.

Final recommendation should be whether or not the reservoir development project is feasible, and if so, under what conditions (including the possibility of further fee schedule adjustments for customers in Rurbania). If this avenue is feasible, when would the bonds be issued, when would the reservoir supply be available, and what would be the impact on the Commission's revenues and expenditures during the first five years of operation?

Instructional Guide #5: Debt Administration

Given the present fee structure of the Rurbania Sewer and Water Utility Commission (as reflected in Table 8-12), Arnold Trunion was quite correct in his rejection of the proposed reservoir development project. This fact can be verified in a number of different ways.

Assuming that local water consumption will continue to increase at an annual rate of approximately eight percent, the additional supply capacity created by this project would be exhausted within eight years, as shown in Table 8-14. Even assuming a reduction in

Table 8-14.-Expanded Supply Capacity, Projected Demand, and Revenue Generated from the Sale of Surplus Water to Other Utilities (in billions of gallons)

Fiscal Year	Supply Capacity	Local Demands	Surplus	Revenues Generated from Sales
t + 2	6.00000	3.80266	2.19734	$ 1,318,404
t + 3	6.00000	4.11113	1.88887	1,133,322
t + 4	6.00000	4.44370	1.55630	933,780
t + 5	6.00000	4.80483	1.19517	717,102
t + 6	6.00000	5.18922	0.81078	486,468
t + 7	6.00000	5.60436	0.39564	237,384
t + 8	6.00000	6.05271	---	---
Total Revenues				$ 4,816,460

the rate of growth of both population and consumption during the next eight years, any capital investment in the construction of the proposed reservoir should not exceed ten years, since the "useful life" of this additional capacity would be approached during that period.

As shown in Table 8-15, the three bonding strategies that have a ten year maturity period range in total debt service costs from $4,520,250 to $4,598,259. If the Utility Commission could sell all of the surplus water available between t + 2 and t + 7, a total of $4,816,460 would be generated in new revenues, thereby making the project "cost feasible" under a straight serial bonding strategy (since $288,988 of these new revenues would have to be paid in taxes, the net funds available for debt service would be $4,527,472).

However, as stated in the scenario, the other local utilities would only buy 750,000,000 gallons annually, which would generate an

Table 8-15.-Analysis of Alternative Bonding Strategies

Bond Type	First Year Debt Service	Average Annual Debt Service	Total Debt Service
Straight Serial (10 yrs. @ 5.30%)	$535,500.00	$452,025.00	$4,520,250
Straight Serial (15 yrs. @ 5.20%)	$415,333.33	$330,400.00	$4,956,000
Straight Serial (20 yrs. @ 4.90%)	$346,500.00	$265,037.50	$5,300,750
Annuity Serial (10 yrs. @ 5.25%)	$458,785.60	$458,785.60	$4,587,856
Annuity Serial (15 yrs. @ 5.00%)	$337,198.06	$337,198.06	$5,057,971
Annuity Serial (20 yrs. @ 4.85%)	$277,288.28	$277,288.28	$5,545,766
Term Bond (10 yrs. @ 5.00%) Sinking Fund	$175,000.00 $284,825.93	$459,825.93	$4,598,259
Term Bond (15 yrs. @ 4.85%) Sinking Fund	$169,750.00 $168,398.35	$338,148.35	$5,072,225
Term Bond (20 yrs. @ 4.50%) Sinking Fund	$157,500.00 $111,566.35	$269,066.35	$5,381,327
Deferred Principal (15 yrs. @ 5.25%)	$183,750.00	$361,958.33	$5,429,375
Deferred Principal (20 yrs. @ 5.00%)	$175,000.00	$310,625.00	$6,212,500

annual net return of $423,000 ($450,000 minus $27,000 in taxes). This yield would not be sufficient to meet the debt service charges on any of the bonding approaches having ten year maturities.

Another approach to this problem would be to examine the alternative. Assuming that the projected annual rate of increase in water capacity (six percent per year with an annual investment of $100,000) could be extended beyond t + 5, the same supply capacity could be achieved by t + 8 as would be produced by the reservoir development project, as shown below:

t + 5	5.08526
t + 6	5.39038
t + 7	5.71380
t + 8	6.05663

The total cost of this alternative would be only $800,000, however, substantial less than the $3,500,000 required for the reservoir development project.

Still another approach would be to test out various bonding strategies against the data available in Table 8-12. Two strategies might be examined: (a) the annuity serial bond with a 20-year maturity, and (b) the deferred principal bond with 15-year maturity. The 20-year annuity serial bond has a first year debt service of $277,288, to which must be added $55,458, or one-fifth of the highest principal and interest requirements as the contribution to the debt service reserve fund. The 15-year deferred principal bond would require an interest payment of $183,750 annually for the first five years, with a debt service payment of $533,750 in the sixth year. Since this sixth year payment represents the maximum principal and interest requirements, the annual contribution to the debt service reserve fund under this approach would be $106,750. Thus, both of these bonding strategies would generate cost commitments during the first five years of operations that fall within the anticipated revenue yields arising from the sale of surplus water to other utilities. However, since the deferred principal bond would place major demands on the RSWUC revenues at the very time that the surplus supply was running out, the 20-year annuity serial bond was chosen to test the impact on the data in Table 8-12.

As shown in Table 8-16, a small revenue surplus is created in t + 3, when current outstanding non-operating expenses drop from $474,243 to $271,400 with the retirement of the term bond. However, thereafter a deficit occurs and continues to increase. Therefore, it must be concluded that under the current fee structure the Utility Commission cannot "afford" any form of bonding strategy that spreads the debt service payments over twenty years.

As these three analytical approaches illustrate, the proposed reservoir development project would not be feasible, verifying the

Table 8-16.-Rurbania Sewer and Water Utility Commission
Projected Revenues and Expenditures with New Reservoir Project

	t + 2	t + 3	t + 4	t + 5
Revenues:				
Local Sale of Water	$2,290,162	$2,468,298	$2,659,615	$2,868,820
Sewer Fees	801,553	863,904	930,865	1,004,087
Sale of Water to Other Utilities	450,000	450,000	450,000	450,000
Other Revenues	70,000	71,610	73,257	74,942
Transfers for Fire Protection	75,000	75,000	75,000	75,000
Rent	562,055	590,158	619,666	650,649
Bank Deposit Interest	9,000	2,390	2,601	641
Interest on Investments	14,500	14,500	14,500	14,500
Total Revenues	$4,272,270	$4,535,860	$4,825,504	$5,138,639
Expenditures:				
Operating Expenses	$3,177,010	$3,494,711	$3,844,182	$4,228,600
Depreciation	270,750	257,213	244,352	232,134
Debt Service Reserve Fund	55,458	55,458	55,458	55,458
Non-Operating	474,243	271,400	261,200	251,000
New Bond	277,288	277,288	277,288	277,288
Taxes (6%)	164,410	175,098	186,577	199,129
Total Expenditures	$4,419,159	$4,531,168	$4,869,057	$5,243,609
Surplus or Deficit	$ 146,889	$ 4,692	$ 43,553	$ 104,970

conclusions reached by Trunion. Under what conditions would it be advisable to undertake this project? If it is assumed that the six percent annual rate of capacity expansion is limited to the next five years, within this period some other solution must be devised if water demands in Rurbania are to continue to expand at the projected (case study) rates.

Projected increases in water consumption might first be re-examined. As the supply capacity is approached and fees must be increased to meet the rising costs of alternative supply systems, it might be more appropriate to assume that, while demand will increase, it will do so at a decreasing rate. Table 8-17 illustrates one alternative rate of demand increase, in which both domestic and flat rate demands are increasing at decreasing rates.

Table 8-17.-Alternative Projections of Metered and Flat Rate Customer Demands for Water in Rurbania

Year	Metered Customers	Monthly Consumption	Annual Consumption	Flat Rate Consumption	Total Consumption
t + 2	24,510	9260	2.72355	1.03177	3.77031
t + 3	25,017	9675	2.90447	1.12979	4.04956
t + 4	25,483	10065	3.07784	1.23658	4.33000
t + 5	25,910	10430	3.24290	1.34762	4.60636
t + 6	26,300	10770	3.39901	1.46258	4.87840
t + 7	26,656	11086	3.54610	1.58111	5.14351
t + 8	26,980	11378	3.68374	1.70284	5.40308
t + 9	27,275	11647	3.81206	1.82739	5.65613
t + 10	27,543	11895	3.93149	1.95437	5.90270
t + 11	27,786	12123	4.04220	2.08338	6.14257
t + 12	28,006	12332	4.14444	2.21403	6.37559
t + 13	28,206	12523	4.23868	2.34593	6.60186

The rate of increase in the number of metered customers shown in Table 8-17 is decreasing at the rate of 10 percent per year (e.g., a 2.3 percent rate of growth between t + 1 and t + 2 would become a 2.07 percent increase between t + 2 and t + 3 and so forth). The rate of growth in monthly consumption is likewise assumed to decrease by 10 percent per year. The increase in flat rate consumption is decreasing at a rate of 5 percent per year. These rate decreases were begun in t + 2 for purposes of this analysis because that is the year in which the current capacity of 3.8 billion gallons will be approached. Total consumption figures include the increasing demands for water supply for fire protection.

As Table 8-17 illustrates, even with the decreases in the rates of demand, the expanded capacity (six percent per year over five years) will be exceeded by t + 7. If construction of the new reservoir project was initiated in t + 4 so that the additional supply that this facility would provide would be available in t + 6, the problem could be averted for at least the next ten years. The 2.2 billion gallon capacity of the new reservoir, when added to the expanded capacity of 5.08526 billion gallons, would result in the surpluses shown in Table 8-18.

Table 8-18.-Projected Demand and Supply of Water in Rurbania and Surplus Available for Sale to Other Utilities

Year	Projected Supply	Local Demand	Available Surplus
t + 2	4.26968	3.77031	0.49937
t + 3	4.52586	4.04956	0.47630
t + 4	4.79741	4.33000	0.46741
t + 5	5.08526	4.60636	0.47890
t + 6	7.28526	4.87840	2.40686
t + 7	7.28526	5.14351	2.14175
t + 8	7.28526	5.40308	1.88218
t + 9	7.28526	5.65613	1.62913
t + 10	7.28526	5.90270	1.38256
t + 11	7.28526	6.14257	1.14269
t + 12	7.28526	6.37559	0.90967
t + 13	7.28526	6.60186	0.68340

Building on the assumption that Trunion's recommendation for a further adjustment in the basic fee schedule will be approved for t + 4, Table 8-19 shows the adjusted fee schedule for various levels of consumption. Flat rate customers would be required to pay $0.0495 per 100 gallons until t + 4, after which time the flat rate charge would be $0.0545 per 100 gallons. It is also assumed that the charge for water sales to other utilities will increase to $0.066 per 100 gallons in T + 4 and that the basic service fee for sewers will advance to 38.5 percent of the water charges.

With these adjustments in the basic fee schedule, it is possible to identify a strategy for the development of the new reservoir site. Construction of the new reservoir would begin in t + 4, with the project funded by a 15-year annuity serial bond (first payment made in t + 5). The cost of the reservoir project is projected to $4,250,000 to account for the impact of inflation. Therefore, the annual debt service on the 15-year

Table 8-19.-Adjusted Basic Fee Schedule for Metered Users

Monthly Gallons Metered	t + 1 to t + 3		t + 4	
	Rate per 100 Gallons	Billing Charges	Rate per 100 Gallons	Billing Charges
1000	$0.0660	$ 0.66	$0.0725	$ 0.725
2000	$0.0660	1.32	$0.0725	1.450
3000	$0.0660	1.98	$0.0725	2.175
4000	$0.0660	2.64	$0.0725	2.900
5000	$0.0660	3.30	$0.0725	3.625
6000	$0.0650	3.95	$0.0715	4.340
7000	$0.0640	4.59	$0.0705	5.045
8000	$0.0630	5.22	$0.0695	5.740
9000	$0.0615	5.835	$0.0675	6.415
10000	$0.0605	6.44	$0.0665	7.080
11000	$0.0595	7.035	$0.0655	7.735
12000	$0.0585	7.62	$0.0645	8.380
13000	$0.0570	8.19	$0.0625	9.005
14000	$0.0560	8.75	$0.0615	9.620
15000	$0.0550	9.30	$0.0605	10.225
16000	$0.0540	9.84	$0.0595	10.820
17000	$0.0530	10.37	$0.0585	11.405
18000	$0.0520	10.89	$0.0570	11.975
19000	$0.0505	11.395	$0.0555	12.530
20000	$0.0495	11.89	$0.0545	13.075

annuity bond (at 5 percent interest rate) would be $409,455, with a total debt service over 15 years of $6,141,822. In addition, in order to build a debt service fund over five years to equal an annual payment equivalent, $74,845 would have to be set aside and invested at 4.5 percent.

Table 8-20 provides a projection of revenues and expenditures, including the debt service charges on the 15-year annuity serial bond. Revenue projections in this table reflect the increase in the basic fee schedule in t + 4; note that a 10 percent increase is also assumed in transfer funds for fire protection. Operating expenditures increase at a rate of 9.5 percent per year, slightly below the rate of increase assumed by Trunion. This adjustment was made to reflect the declining rates of increase in consumption.

As shown in Table 8-20, a revenue surplus is projected to t + 4, the year in which the new fee schedule goes into effect. In year t + 5, there is a deficit as both the capacity expansion

Table 8-20. Rurbania Sewer and Water Utility Commission
Projected Revenues and Expenditures with 15-Year Annuity
Serial Bond to Finance New Reservoir Project

	t + 2	t + 3	t + 4	t + 5	t + 6
Revenues:					
Local Sale of Water	$2,273,181	$2,433,532	$2,851,991	$3,023,336	$3,190,727
Sewer Fees	795,613	851,736	1,098,017	1,163,984	1,228,430
Sale of Water to Other Utilities	299,622	285,780	308,490	316,074	450,000
Transfers for Fire Protection	75,000	75,000	82,500	82,500	82,500
Rent	562,055	590,158	619,666	650,649	683,181
Bank Deposit Interest	9,000	3,017	2,969	20,562	17,251
Interest on Investments	14,500	14,500	14,500	14,500	14,500
Total Revenues	$4,028,971	$4,253,723	$4,978,133	$5,271,605	$5,666,589
Expenditures:					
Operating Expenses	$3,162,569	$3,463,013	$3,791,999	$4,152,239	$4,546,702
Depreciation	270,750	257,213	244,352	232,134	220,527
Non-Operating	474,243	271,400	261,200	251,000	240,800
Taxes	154,368	163,159	189,624	200,365	218,444
Capacity Expansion	100,000	100,000	100,000	100,000	---
New Reservoir Project				409,455	409,455
Debt Service Fund				74,845	74,845
Total Expenditures	$4,161,930	$4,254,785	$4,587,180	$5,420,037	$5,710,772
Surplus or Deficit	$ 132,959	$ 1,062	$ 390,953	$ 148,432	$ 44,183
Year-End Bank Reserves	$ 67,041	$ 65,979	$ 456,932	$ 383,345	$ 414,007

project and the debt service on the annuity serial bond must be funded. The following year (t + 6) deficit of $44,183, however, is a "paper deficit" in that the $74,845 payment to the debt service fund is actually included in the bank reserves of the Commission. By year t + 9, when the two outstanding bond issues are finally retired, this paper deficit should also be eliminated.

Commentary

This final scenario problem illustrates the close linkage between capital facilities planning and fiscal policies regarding the generation of revenue. Although Trunion's analysis clearly documented the need for additional water supply capacity to meet increasing service demands in Rurbania, the development of a new reservoir could not be undertaken until the Commission is willing to consider adjustments in its fiscal policies regarding the basic fee schedule. The delay in initiating this project will cost an additional $1,083,851 in debt service, i.e., the difference in total debt service costs between year t and year t + 4 to fund a 15-year annuity serial bond issue. This amounts to approximately $216,770 per year over the five years that the project is deferred. An additional 7.5 percent increase in the basic fee schedule in year t would make it possible to initiate the reservoir project in year t + 1, and would actually cost the City of Rurbania (i.e., the customers of the RSWUC) less than the $1,083,851 that will be incurred in additional debt service charges.

ENDNOTES

1. For sample formats for these ledgers and reporting forms, see: Alan Walter Steiss, Local Government Finance: Capital Facilities Planning and Debt Administration (Lexington, Mass.: D.C. Heath and Company, 1975), pp. 175-182.

2. In the past, municipal sinking funds have encountered difficulties by investing in real mortgages, railroad stock, and other private corporate obligations.

3. The practice of refunding mature or maturing bonds should be avoided if al all possible, and if necessary, should be undertaken with great discretion.

4. George H. Hempel, Measures of Municipal Bond Quality (Ann Arbor: Bureau of Business Research, University of Michigan, 1967), p. 59.